Transport and Infrastructure Net Zero Consultation Roadmap

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Department of Climate Change, Energy, Environment and Water

Response received at:
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1 Confirm that you have read and understand this privacy notice.
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2 Please indicate how and if you want your submission published.
Public

3 Published name
Beyond Zero Emissions

4 Confirm that you have read and understand this declaration.
Yes

5 First name
Beth

6 Last name
Mitchell

7 Email
[redacted]

8 Phone

[redacted]

9 Who are you answering on behalf of?

Organisation

10 Organisation name

Beyond Zero Emissions

11 What best describes you or your organisation?

Not for profit

12 What sector do you represent?

Climate change/net zero

13 What state or territory do you live in?

Victoria

14 Postcode

3002

15 What area best describes where you live?

City

16 1. Do you support the proposed guiding principles?

Yes

17 1.1 Please add details to your response.

Yes, BZE broadly supports this approach. BZE takes an emission hierarchical approach to the
transport sector, given the majority of these emissions are in road transport (88%) this should be the main priority and focus of transport decarbonisation activity.
The most effective pathway to decarbonising Australia's fastest growing emissions sector will be a multipronged approach encompassing the avoid-shift-improve framework. While

avoid and shift pathways are not within BZE's remit, BZE acknowledges technology uptake such as electric vehicles alone will be insufficient to meet 1.5 targets and a higher level of avoidance/mode shift will be required alongside electric vehicle deployment.

18 ## 2. Do you support the use of the avoid-shift-improve framework as a tool to identify opportunities for abatement?

Yes

19 ## 2.1 Please add details to your response.

Yes, BZE broadly supports this approach. BZE takes an emission hierarchical approach to the
transport sector, given the majority of these emissions are in road transport (88%) this should be the main priority and focus of transport decarbonisation activity.
The most effective pathway to decarbonising Australia's fastest growing emissions sector will be a multipronged approach encompassing the avoid-shift-improve framework. While avoid and shift pathways are not within BZE's remit, BZE acknowledges technology uptake such as electric vehicles alone will be insufficient to meet 1.5 targets and a higher level of avoidance/mode shift will be required alongside electric vehicle deployment.

20 ## 3. Do you agree the development of a national policy framework for active and public transport will support emissions reduction?

Yes

21 ## 3.1 Please add details to your response.

Although active transport is not in our remit, BZE supports the need for a national policy framework for active and public transport to drive accelerated emissions reduction.
Mode shift offers a huge potential to reduce both passenger and commercial transport emissions.
There is a significant opportunity to reduce emissions with public and active transport that also provides health and safety benefits to the community. This requires a range of infrastructure work and greater expenditure on public and active transport that should be prioritised as part of transport spending. The UN recommends that 20% of the overall transport budget be spent on active and public transport, the Climate Council recommends 70% of the transport budget should be spent here.

22 ## 4. What should be included in a national policy framework for active

and public transport and how should it be developed?

BZE welcomes the QLD government's announcement to develop electric bus manufacturing,
however Australia needs to ensure a national coordination approach is taken. This would help
ensure that the existing onshore bus manufacturing industry is incentivised to transition to electric drive trains.
Recommendation: Secure a zero-emission government bus fleet declaration from state and
territory governments and coordinate government bus procurement procedures across all levels of government to give local manufacturers the opportunity to scale their operations and meet demand. This can be achieved through the Energy and Climate change Ministerial Council.

23 ## 5. What additional actions by governments, communities, industry and other stakeholders need to be taken now and in the future to ensure the movement of people contributes to transport emissions reduction?

Not answered

24 ## 6.1 What additional actions by governments, communities, industry and other stakeholders need to be taken now and in the future to ensure that the movement of goods contributes to transport emissions reduction?

Recommendation: Set a target of 100% of new commercial vehicle sales to be zero emissions by 2030 within the Transport and Infrastructure Net Zero Roadmap and Action Plan.

Four Australian states and territories (NSW, VIC, SA and ACT) have already committed to the
Glasgow Declaration on Clean Commercial Vehicles(CEV). This declaration establishes an interim goal for 30% of new commercial vehicles to be zero-emission by 2030, increasing to 100% by 2040. Federally, we have yet to officially announce or establish a specific target for CEV adoption.

We encourage the government to be far more ambitious with the rollout of CEVs and recommend setting a national target for commercial electric vehicles within the Transport and Infrastructure Net Zero Roadmap and Action Plan. For 100% of new

commercial vehicle sales to be zero-emission by 2030, it is recommended that the Action Plan adopt biannual targets to track progress and allow for incentives to be reviewed for their impact.

Recommendation: Set a target to retrofit 20,000 ICE trucks to electric by 2030
There are a large number of vehicles on the road that require an engine rebuild in their lifetime. There is a clear opportunity to incentivise this engine rebuild to be a conversion from a diesel to an electric drivetrain. Including retrofits in production tax credits or other incentives for CEV can incentivise this conversion and retain and grow existing capability, for example Janus trucks.

Recommendation: Support the transition of existing commercial vehicle manufacturers
The commercial vehicle industry currently employs 34,000 people, comparable to the entire coal industry with 34,600. This is an industry that requires support to grow its capability in
manufacturing electric vehicle variants if we are to retain existing jobs and grow new onshore jobs.

Unlike passenger vehicles, global manufacturing capacity for CEVs is currently low. As demand for CEVs increases, global manufacturing capacity will follow suit. During this establishment phase, Australia has an opportunity to become a key player while reducing emissions in this sector and growing demand for parallel supply chains, notably for battery energy storage.

Building the onshore CEV industry can ensure that we have access to the vehicles we need in
addition to supporting parallel industries including battery, local train and tram manufacturing and maintenance capability.

25 ## 6.2. How would these actions address the identified challenges and opportunities for emissions reduction in the movement of goods?

Recommendation: Deploy and make commercial electric vehicles here
A strong focus on deploying and manufacturing commercial electric vehicles will deliver the twin benefits of emissions reduction and the long term viability of the commercial vehicle workforce in Australia.
Commercial vehicles (including buses, trucks and light commercial vehicles) currently release 9% of Australian annual emissions (equal to 39 MtCO2-e per year) and this is likely to increase to 12% (equal to 43 MtCO2-e per year) by 2030 if no action is taken.
The commercial vehicle industry currently employs 34,000, at 2021-22 census the coal

industry employed 34,600. This is an industry we need to transition for both the future of the onshore jobs and access to the vehicles that we need to decarbonise transport. Building the onshore CEV industry can also support opportunities in local train and tram manufacturing and maintenance capability.
See recommendations listed in 6.1

26 7. Do you agree with the proposed net zero pathway for light road vehicles?

No

27 7.1 Please add details to your response.

BZE strongly agrees that electrification is the clear technology to decarbonise light vehicles.
The multiple benefits of electrification far outweighs any need to consider hydrogen fuel cells in Australia for light vehicles. Electric vehicles will continue to fall in price, have the cheapest
operating costs to increase in range with ongoing innovation in battery technologies, and offer co-benefits through vehicle-to-grid firming. The potential for battery energy storage technologies within electric vehicles to provide these co benefits is rapidly reaching the maturity to deliver grid firming benefits, as demonstrated recently by the ACT Government fleet.
BZE does not agree that hydrogen fuel cells for light vehicles will serve a role in Australia's
energy transition.
Hydrogen is unlikely to be competitive long term, carries yet to be resolved challenges around
transportation and storage and should be viewed as a fuel leveraged directly for hard to abate
sectors which light vehicles are not.

28 8. The Australian Government is currently developing an Australian New Vehicle Efficiency Standard and has already begun to implement actions in the National Electric Vehicle Strategy.8.1 What additional actions by governments, communities, industry and other stakeholders need to be taken now and in the future to reduce light vehicle emissions?

Recommendation: Set a target of 100% of new commercial vehicle sales to be zero

emissions by 2030 within the Transport and Infrastructure Net Zero Roadmap and Action Plan.
Four Australian states and territories (NSW, VIC, SA and ACT) have already committed to the
Glasgow Declaration on Clean Commercial Vehicles. This declaration establishes an interim goal for 30% of new commercial vehicles to be zero-emission by 2030, increasing to 100% by 2040.
Federally we have yet to officially announce or establish a specific target for CEV adoption. We believe there is room to be far more ambitious with the rollout of CEVs and recommend setting a national target for commercial electric vehicles within the Transport and Infrastructure Net Zero Roadmap and Action Plan. For 100% of new commercial vehicle sales to be zero-emission by 2030, it is recommended that the Action Plan adopt biannual targets to track progress and allow for incentives to be reviewed for their impact.
Recommendation: build a circular economy around the CEV industry
Establishing a circular economy for commercial electric vehicles will ensure that new vehicles build in the opportunity for cost effective battery upgrades in addition to enabling the reuse and recycling of batteries and other components. This can be achieved by setting industry design standards for new CEVs in consultation with industry groups such as the Zero Emission Vehicle National Innovation Council (ZEVNIC).
To incentivise retrofitting of existing CEVs, retrofits could be eligible for tax credits similar to
production tax credits or a repurposed instant asset tax write-off on the retrofit costs.

29 ## 8.2 How would these actions address the identified challenges and opportunities to reduce light vehicle emissions?

Light commercial vehicles release ~4% of Australian annual emissions (equal to 16 MtCO2-e per year) and this is expected to increase in line with overall commercial vehicle emissions by 2030 if no action is taken

30 ## 9. Do you agree with the proposed net zero pathway for heavy road vehicles?

No

31 ## 9.1 Please add details to your response

It is unclear how much investment will flow into electrification vs LCLFs and FCEVs.
Recommendation: Expedite investment in heavy vehicle electrification and supporting infrastructure

There is room to be far more ambitious with the rollout of CEVs and recommend setting a national target for commercial electric vehicles within the Transport and Infrastructure Net Zero Roadmap and Action Plan to support investment
 BZE's Deploy sets roll-out rates of electric vehicles required to replace existing stock and
keep emissions in line with 1.5 targets.
Recommendation: Set target - Retrofit 20,000 ICE trucks to electric by 2030
This recommendation acknowledges that there are a large number of vehicles on the road that require an engine rebuild in their lifetime. We recommend that retrofits be incentivise through mechanisms including production tax credits or tax write-offs for CEV.

32 10. The proposed pathway for heavy road vehicles relies on a mix of battery electric, hydrogen fuel-cell and low carbon liquid fuels.Rank from 1 to 3, the order in which these should be prioritised for emissions reduction.

Not answered

33 10.1 Please add details to your response. Why did you rank them in that order?

In terms of both technological maturity and cost effectiveness BZE ranks:
1. Battery electric
2. Hydrogen fuel cell
3. Low carbon liquid fuels
Technology maturity, simplicity of installing and regulating 'refuelling' infrastructure and the
potential of battery electric technology to deliver a suite of co-benefits to owners and the electricity grid see it rank number 1.
BZE's research and expert advice is that Australia's pursuit of green hydrogen be leveraged for very specific hard to abate sectors (e.g. green steel) for which heavy vehicles are not one. BZE sees hydrogen as a precious resource. The rate at which battery innovation is delivering lower cost, increasingly longer range batteries that can already be powered by 100% renewables make it a clear technology to invest heavily in, including for heavy vehicles.
LCLF's are a technological distraction for heavy vehicles decarbonisation and there is no commercially available LCFC for vehicles in Australia let alone the supporting infrastructure.

34 11. What role should low carbon liquid fuels play in the heavy vehicle decarbonisation?

Recommendation: Prioritise electric vehicle deployment and real zero carbon options.
Although LCLFs can reduce some emissions, we recommend efforts to focus on zero carbon
options.
The principal concern with LCLFs is technology maturity, economic viability and land use conflicts.

35 12. What additional actions by governments, communities, industry and other stakeholders need to be taken now and in the future to reduce heavy vehicle emissions?

Set target - Retrofit 20,000 ICE trucks to electric by 2030
Acknowledge that there are a large number of vehicles on the road that require an engine rebuild in their lifetime and we need to incentivise this to be a conversion from diesel to electric Include retrofits in production tax credits or other incentives for CEV

36 13. Do you agree with the proposed net zero pathway for rail?

Not answered

37 13.1 Please add details to your response.

Not answered

38 14. The proposed pathway for rail relies on a mix of battery electric, hydrogen fuel-cell and low carbon liquid fuels.Rank from 1 to 3, the order in which these should be prioritised for emissions reduction.

Not answered

39 14.1 Please add details to your response. Why did you rank them in that order?

Not answered

40 15. What role should low carbon liquid fuels play in rail decarbonisation?

Not answered

41 16. What additional actions by governments, communities, industry and other stakeholders need to be taken now and in the future to reduce rail emissions?

Not answered

42 16.1 How would these actions address the identified challenges and opportunities to reduce rail emissions?

Not answered

43 17. Do you agree with the proposed net zero pathway for maritime?

Not answered

44 17.1 Please add details to your response.

Not answered

45 18. The Australian Government is engaging in consultation as part of the development of the Maritime Emissions Reduction National Action Plan and those consultations will also inform the final Roadmap and Action Plan. 18.1 What additional actions by governments, communities, industry and other stakeholders need to be taken now and in the future to reduce maritime emissions?

Not answered

46 18.2 How would these actions address the identified challenges and opportunities to reduce maritime emissions?

Not answered

47 19. Do you agree with the proposed net zero pathway for aviation?

Not answered

48 19.1 Please add details to your response.

Not answered

49 20. The Australian Government has already engaged in consultation on aviation decarbonisation through the development of the Aviation White Paper and those consultations will also inform final Roadmap and Action Plan.

Not answered

50 20.1 What additional actions by governments, communities, industry and other stakeholders need to be taken now and in the future to reduce aviation emissions?

Not answered

51 21. Do you agree with the proposed net zero pathway for transport infrastructure?

Yes

52 21.1 Please add details to your response.

BZE strongly supports the focus on the embodied emissions associated with transport infrastructure.
In addition, there is also a need to include infrastructure for a circular economy.
Recommendation: Build a circular economy around the CEV industry
Set industry design standards for new CEVs in consultation with groups such as the Zero Emission Vehicle National Innovation Council (ZEVNIC) to enable convenient future battery upgrades, and reuse and recycling of batteries and other components.
Also, incentivise retrofitting of existing CEVs by enabling them to access the production tax credits for new vehicles.

53 22. What additional actions by governments, communities, industry and other stakeholders need to be taken now and in the future to reduce transport infrastructure emissions and ensure that transport infrastructure is ready for and enables low-emission transport modes?

Recommendation: Ensure a National Supergrid is built to meet transport sector electrification demand
Beyond Zero Emissions proposes a $20 billion investment program over the next five

years to build the National Supergrid foundations. The government's Rewiring the Nation initiative points Australia in the right direction but we need to move faster and do more. Rapid, coordinated grid infrastructure upgrades are the necessary path to accelerate our emissions reduction and put Australia in line with the IPCC 1.5°C scenario.
Recommendation: Invest in Renewable Energy Industrial Precincts to support the decarbonisation of key inputs to the Commercial Electric Vehicle supply chains, for example
green steel and aluminium and battery energy storage.
Prioritise grid investment and a rollout of renewables that is appropriately scaled and designed to power zero-emission industries via Renewable Energy Industrial Precincts in key regional industrial ecosystems such as the Hunter, Gladstone and Kwinana. This will enable the inputs (embodied carbon) to locally manufactured CEV built on shore to be decarbonised.

54 ## 22.1 How would these actions address the identified challenges and opportunities to reduce transport infrastructure emissions?

The recommendations within BZE's National Supergrid enable a just energy transition across
Australia' urban, regional, rural and remote communities. Recommendations within the report are key enablers as they provide the grid resources required to develop a national electric vehicle charging infrastructure.
Reduction of transport emissions should be considered across the supply chain to reduce the
embodied carbon of the industry if true zero emission vehicles are to be produced. Key inputs to vehicles include steel, aluminium and battery energy storage, the majority production of which is currently centred around existing industrial regions. Powering these regions with renewable energy allows these inputs to be decarbonised and reduces the embodied carbon in the production of locally and globally manufactured vehicles using our raw materials and clean technologies.

55 ## 23. What additional actions by governments, communities, industry and other stakeholders need to be taken now and in the future to ensure the energy mix is ready to support transport emissions reduction?

The transport sector can drive significant demand for Australian made batteries, in particular, the commercial electric vehicle sector. BZE research has shown that significant demand can be created through developing Australia's CEV sector to scale the industry, see BZE Battery Supply Chains. This represents a significant opportunity to deliver on

Australia's Future Made in Australia intent to build onshore supply chains around Australia's unique resource advantages including critical minerals to make electric vehicle batteries.

56 24. How should the use of low carbon liquid fuels (LCLFs) be prioritised across different transport modes over time to achieve maximum abatement?

Where there is no electric alternative.

57 25. What are the best ways for the Australian Government to work collaboratively with industry, business, governments and communities to implement the proposed pathways?

Not answered

58 25.1 What are good domestic or international examples of partnership and collaboration on transport and transport infrastructure emissions reduction that could inform the final Roadmap and Action Plan?

Not answered

59 25.2 What opportunities can Government leverage to show leadership in Australia and internationally?

Not answered

60 26. What measures and metrics should be used to evaluate the final Transport and Infrastructure Net Zero Roadmap and Action Plan?

Not answered

61 26.1 What other data and evidence could governments use and how could this offer further insights on the pace, scale and location of transport emissions reduction pathways?

Not answered

62 27. Do you have any feedback on the proposed review process?

Not answered

63 28. Do you have any further feedback on the Consultation Roadmap and proposed pathways?

Not answered

64 28.1 Is there anything missing? Are the sections appropriately integrated? Is the Roadmap appropriately ambitious?

Not answered

65 29. Is there any further information or documentation that you wish to be considered with your submission?

Not answered

66 Would you like to upload a document?

Yes

67 Have you removed any identifying information from your submission?

Yes

68 Upload a submission

BZE Submission to Transport and Infrastructure Net Zero Consultation Roadmap.pdf

69 Upload a submission

BZE 2023 - Commercial EV Supply Chain Briefing Paper.pdf

70 Upload supporting file

Not answered

71 Upload supporting file

Not answered

July 2024

To the Department of Infrastructure, Transport, Regional Development Communication and the Arts,

Thank you for the opportunity to make a submission for the Transport and Infrastructure Net Zero Roadmap. Beyond Zero Emissions (BZE) is an independent solution-focused think tank and we strongly endorse the Australian Government's work on advancing towards a zero-carbon transport system.

BZE's latest briefing paper Commercial Electric Vehicle Supply Chains is of greatest relevance to the roadmap and has been attached to this submission. It outlines how deployment of commercial electric vehicles (buses, trucks and light commercial vehicles) and onshore manufacturing of parts of this supply chain can help drive down Australia's emissions while growing economic prosperity.

Commercial vehicles currently release 9% of Australian annual emissions (equal to 39 Mt CO2-e per year) and this is likely to increase to 12% (equal to 43 Mt CO2-e per year) by 2030 if no action is taken.

Unlike passenger vehicles, global manufacturing capacity for CEVs is currently low. As demand for CEVs increases, global manufacturing capacity will follow suit. During this establishment phase, Australia has an opportunity to become a key player while reducing emissions in this sector and growing demand for parallel supply chains, notably for battery energy storage.

Supporting Australia's existing bus and truck manufacturing industry to pivot to electric vehicle production can also secure and grow the long term jobs in this industry. **The industry currently employs 54,000 people, equivalent to the number of people employed in the coal industry**.

We welcome this consultation and are available to provide detailed briefing of our work upon request. net zero roadmap include:

- **Recommendation 1:** Set targets for the sales of commercial electric vehicles that pave the way for all buses and trucks in Australia to be zero emissions by 2040.
- **Recommendation 2:** Support the transition of existing commercial vehicle manufacturers by making commercial electric vehicles here as part of a Future Made in Australia
- **Recommendation 3:** build circular economy infrastructure to support sector sustainability long-term

Yours Sincerely, Beth Mitchell

Head of Engagement, Beyond Zero Emissions. [redacted]

Responses to consultation questions:

1.. Do you agree with the proposed guiding principles? Yes **1.1. Please add details to your response.**
Yes.
2. Do you support the use of the avoid-shift-improve framework as a tool to identify opportunities for abatement?
Yes, BZE broadly supports this approach. BZE takes an emission hierarchical approach to the transport sector, given the majority of these emissions are in road transport (88%) this should be the main priority and focus of transport decarbonisation activity. The most effective pathway to decarbonising Australia's fastest growing emissions sector will be a multipronged approach encompassing the avoid-shift-improve framework. While avoid and shift pathways are not within BZE's remit, BZE acknowledges technology uptake such as electric vehicles alone will be insufficient to meet 1.5 targets and a higher level of avoidance/mode shift will be required alongside electric vehicle deployment.
3. Do you agree the development of a national policy framework for active and public transport will support emissions reduction?
Yes. Although active transport is not in our remit, BZE supports the need for a national policy framework for active and public transport to drive accelerated emissions reduction. Mode shift offers a huge potential to reduce both passenger and commercial transport emissions. There is a significant opportunity to reduce emissions with public and active transport that also provides health and safety benefits to the community. This requires a range of infrastructure work and greater expenditure on public and active transport that should be prioritised as part of transport spending. The UN recommends that 20% of the overall transport budget be spent on active and public transport, the Climate Council recommends 70% of the transport budget should be spent here.
4. What should be included in a national policy framework for active and public transport and how should it be developed?
BZE welcomes the QLD government's announcement to develop electric bus manufacturing, however Australia needs to ensure a national coordination approach is taken. This would help ensure that the existing onshore bus manufacturing industry is incentivised to transition to electric drive trains.

Recommendation: Secure a zero-emission government bus fleet declaration from state and territory governments and coordinate government bus procurement procedures across all levels of government to give local manufacturers the opportunity to scale their operations and meet demand. This can be achieved through the Energy and Climate change Ministerial Council.

5. What additional actions by governments, communities, industry and other stakeholders need to be taken now and in the future to ensure the movement of people contributes to transport emissions reduction?

N/A

6. The Australian Government has already engaged in consultation on the 2023 review of the National Freight and Supply Chain Strategy and those consultations will also inform the final Roadmap and Action Plan.

6.1. What additional actions by governments, communities, industry and other stakeholders need to be taken now and in the future to ensure that the movement of goods contributes to transport emissions reduction?

Recommendation: Set a target of 100% of new commercial vehicle sales to be zero emissions by 2030 within the Transport and Infrastructure Net Zero Roadmap and Action Plan.
Four Australian states and territories (NSW, VIC, SA and ACT) have already committed to the Glasgow Declaration on Clean Commercial Vehicles(CEV). This declaration establishes an interim goal for 30% of new commercial vehicles to be zero-emission by 2030, increasing to 100% by 2040. Federally, we have yet to officially announce or establish a specific target for CEV adoption. We encourage the government to be far more ambitious with the rollout of CEVs and recommend setting a national target for commercial electric vehicles within the Transport and Infrastructure Net Zero Roadmap and Action Plan. For 100% of new commercial vehicle sales to be zero-emission by 2030, it is recommended that the Action Plan adopt biannual targets to track progress and allow for incentives to be reviewed for their impact.

Recommendation: Set a target to retrofit 20,000 ICE trucks to electric by 2030
There are a large number of vehicles on the road that require an engine rebuild in their lifetime. There is a clear opportunity to incentivise this engine rebuild to be a conversion from a diesel to an electric drivetrain. Including retrofits in production tax credits or other incentives for CEV can incentivise this conversion and retain and grow existing capability, for example Janus trucks. .

Recommendation: Support the transition of existing commercial vehicle manufacturers
The commercial vehicle industry currently employs 34,000 people, comparable to the entire coal industry with 34,600. This is an industry that requires support to grow its capability in manufacturing electric vehicle variants if we are to retain existing jobs and grow new onshore jobs.

Unlike passenger vehicles, global manufacturing capacity for CEVs is currently low. As demand for CEVs increases, global manufacturing capacity will follow suit. During this establishment phase, Australia has an opportunity to become a key player while reducing emissions in this sector and growing demand for parallel supply chains, notably for battery energy storage.

Building the onshore CEV industry can ensure that we have access to the vehicles we need in addition to supporting parallel industries including battery, local train and tram manufacturing and maintenance capability.

6.2. How would these actions address the identified challenges and opportunities for emissions reduction in the movement of goods?

Recommendation: Deploy and make commercial electric vehicles here
A strong focus on deploying and manufacturing commercial electric vehicles will deliver the twin benefits of emissions reduction and the long term viability of the commercial vehicle workforce in Australia.

Commercial vehicles (including buses, trucks and light commercial vehicles) currently release 9% of Australian annual emissions (equal to 39 MtCO2-e per year) and this is likely to increase to 12% (equal to 43 MtCO2-e per year) by 2030 if no action is taken.

The commercial vehicle industry currently employs 34,000, at 2021-22 census the coal industry employed 34,600. This is an industry we need to transition for both the future of the onshore jobs and access to the vehicles that we need to decarbonise transport.

Building the onshore CEV industry can also support opportunities in local train and tram manufacturing and maintenance capability.

See recommendations listed in 6.1:

- **Recommendation: Set a target to retrofit 20,000 ICE trucks to electric by 2030**
- **Recommendation: Support the transition of existing commercial vehicle manufacturers**

7. Do you agree with the proposed net zero pathway for light road vehicles?
7.1. Please add details to your response.

BZE does not agree with the net zero pathway for light road vehicles in full.
BZE strongly agrees that electrification is the clear technology to decarbonise light vehicles. The multiple benefits of electrification far outweighs any need to consider hydrogen fuel cells in Australia for light vehicles. Electric vehicles will continue to fall in price, have the cheapest operating costs to increase in range with ongoing innovation in battery technologies, and offer co-benefits through vehicle-to-grid firming. The potential for battery energy storage technologies within electric vehicles to provide these co benefits is rapidly reaching the maturity to deliver grid firming benefits, as demonstrated recently by the ACT Government fleet.

BZE does not agree that hydrogen fuel cells for light vehicles will serve a role in Australia's energy transition.

Hydrogen is unlikely to be competitive long term, carries yet to be resolved challenges around transportation and storage and should be viewed as a fuel leveraged directly for hard to abate sectors which light vehicles are not.

8. The Australian Government is currently developing an Australian New Vehicle Efficiency Standard and has already begun to implement actions in the National Electric Vehicle Strategy.

8.1 What additional actions by governments, communities, industry and other stakeholders need to be taken now and in the future to reduce light vehicle emissions?

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Recommendation: build a circular economy around the CEV industry
Establishing a circular economy for commercial electric vehicles will ensure that new vehicles build in the opportunity for cost effective battery upgrades in addition to enabling the reuse and recycling of batteries and other components. This can be achieved by setting industry design standards for new CEVs in consultation with industry groups such as the Zero Emission Vehicle National Innovation Council (ZEVNIC).

To incentivise retrofitting of existing CEVs, retrofits could be eligible for tax credits similar to production tax credits or a repurposed instant asset tax write-off on the retrofit costs.

8.2. How would these actions address the identified challenges and opportunities to reduce light vehicle emissions?

Light commercial vehicles release ~4% of Australian annual emissions (equal to 16 MtCO2-e per year) and this is expected to increase in line with overall commercial vehicle emissions by 2030 if no action is taken.

9. Do you agree with the proposed net zero pathway for heavy road vehicles?
9.1. Please add details to your response.

No. It is unclear how much investment will flow into electrification vs LCLFs and FCEVs.

Recommendation: Expedite investment in heavy vehicle electrification and supporting infrastructure

There is room to be far more ambitious with the rollout of CEVs and recommend setting a national target for commercial electric vehicles within the Transport and Infrastructure Net Zero Roadmap and Action Plan to support investment

- BZE's Deploy sets roll-out rates of electric vehicles required to replace existing stock and keep emissions in line with 1.5 targets.

Recommendation: Set target - Retrofit 20,000 ICE trucks to electric by 2030

This recommendation acknowledges that there are a large number of vehicles on the road that require an engine rebuild in their lifetime. We recommend that retrofits be incentivise through mechanisms including production tax credits or tax write-offs for CEV.

10. The proposed pathway for heavy road vehicles relies on a mix of battery electric, hydrogen fuel cell and low carbon liquid fuels. Rank from 1 to 3 the order in which these should be prioritised for emissions reduction.

10.1. Please add details to your response. Why did you rank them in that order?

In terms of both technological maturity and cost effectiveness BZE ranks:

1. Battery electric
2. Hydrogen fuel cell
3. Low carbon liquid fuels

Technology maturity, simplicity of installing and regulating 'refuelling' infrastructure and the potential of battery electric technology to deliver a suite of co-benefits to owners and the electricity grid see it rank number 1.

BZE's research and expert advice is that Australia's pursuit of green hydrogen be leveraged for very specific hard to abate sectors (e.g. green steel) for which heavy vehicles are not one. BZE sees hydrogen as a precious resource. The rate at which battery innovation is delivering lower cost, increasingly longer range batteries that can already be powered by 100% renewables make it a clear technology to invest heavily in, including for heavy vehicles.

LCLF's are a technological distraction for heavy vehicles decarbonisation and there is no commercially available LCFC for vehicles in Australia let alone the supporting infrastructure.

11. What role should low carbon liquid fuels play in heavy vehicle decarbonisation?

Recommendation: Prioritise electric vehicle deployment and real zero carbon options. Although LCLFs can reduce some emissions, we recommend efforts to focus on zero carbon options.

The principal concern with LCLFs is technology maturity, economic viability and land use conflicts.

12. What additional actions by governments, communities, industry and other stakeholders need to be taken now and in the future to reduce heavy vehicle emissions?

Set target - Retrofit 20,000 ICE trucks to electric by 2030 Acknowledge that there are a large number of vehicles on the road that require an engine rebuild in their lifetime and we need to incentivise this to be a conversion from diesel to electric Include retrofits in production tax credits or other incentives for CEV
12.1. How would these actions address the identified challenges and opportunities to reduce heavy vehicle emissions?
N/A
13. Do you agree with the proposed net zero pathway for rail? **13.1. Please add details to your response.**
N/A
14. The proposed pathway for rail relies on a mix of battery electric, hydrogen fuel cell and low carbon liquid fuels. Rank from 1 to 3 the order in which these should be prioritised for emissions reduction. **14.1. Please add details to your response. Why did you rank them in that order?**
N/A
16. What additional actions by governments, communities, industry and other stakeholders need to be taken now and in the future to reduce rail emissions?
N/A
21. Do you agree with the proposed net zero pathway for transport infrastructure? **21.1. Please add details to your response.**
Yes, broadly. BZE strongly supports the focus on the embodied emissions associated with transport infrastructure.

In addition, there is also a need to include infrastructure for a circular economy.
Recommendation: Build a circular economy around the CEV industry
Set industry design standards for new CEVs in consultation with groups such as the Zero Emission Vehicle National Innovation Council (ZEVNIC) to enable convenient future battery upgrades, and reuse and recycling of batteries and other components.

Also, incentivise retrofitting of existing CEVs by enabling them to access the production tax credits for new vehicles.

22. What additional actions by governments, communities, industry and other stakeholders need to be taken now and in the future to reduce transport infrastructure emissions and ensure that transport infrastructure is ready for and enables low-emission transport modes?

Recommendation: Ensure a National Supergrid is built to meet transport sector electrification demand
Beyond Zero Emissions proposes a $20 billion investment program over the next five years to build the National Supergrid foundations. The government's Rewiring the Nation initiative points Australia in the right direction but we need to move faster and do more. Rapid, coordinated grid infrastructure upgrades are the necessary path to accelerate our emissions reduction and put Australia in line with the IPCC 1.5°C scenario.

Recommendation: Invest in Renewable Energy Industrial Precincts to support the decarbonisation of key inputs to the Commercial Electric Vehicle supply chains, for example green steel and aluminium and battery energy storage.
Prioritise grid investment and a rollout of renewables that is appropriately scaled and designed to power zero-emission industries via Renewable Energy Industrial Precincts in key regional industrial ecosystems such as the Hunter, Gladstone and Kwinana. This will enable the inputs (embodied carbon) to locally manufactured CEV built on shore to be decarbonised.

22.1. How would these actions address the identified challenges and opportunities to reduce transport infrastructure emissions?

The recommendations within BZE's National Supergrid enable a just energy transition across Australia' urban, regional, rural and remote communities. Recommendations within the report are key enablers as they provide the grid resources required to develop a national electric vehicle charging infrastructure.

Reduction of transport emissions should be considered across the supply chain to reduce the embodied carbon of the industry if true zero emission vehicles are to be produced. Key inputs to vehicles include steel, aluminium and battery energy storage, the majority production of which is currently centred around existing industrial regions. Powering these regions with renewable energy allows these inputs to be decarbonised and reduces the embodied carbon in the production of locally and globally manufactured vehicles using our raw materials and clean technologies.

23. The Australian Government invited views on aspects of the energy transformation that represent the most material challenges and opportunities for the electricity and energy sector. **What additional actions by governments, communities, industry and other stakeholders need to be taken now and in the future to ensure the energy mix is ready to support transport emissions reduction?**
The transport sector can drive significant demand for Australian made batteries, in particular, the commercial electric vehicle sector. BZE research has shown that significant demand can be created through developing Australia's CEV sector to scale the industry, see BZE Battery Supply Chains. This represents a significant opportunity to deliver on Australia's Future Made in Australia intent to build onshore supply chains around Australia's unique resource advantages including critical minerals to make electric vehicle batteries.
24. How should the use of low carbon liquid fuels be prioritised across different transport modes over time to achieve maximum abatement?
Where there is no electric alternative.

beyond ZERO emissions

Commercial Electric Vehicles Supply Chains

BRIEFING PAPER - OCTOBER 2023

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Acknowledgements

Project staff

Strategic oversight: Heidi Lee
Lead authors: Rowan Moorey, and Tejesh Kashyap
Support: Jane Sewell, Beth Mitchell and Nikki Potter
Volunteer: Cristobal Gallegos

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BZE Project Advisory Board

Stephanie Bashir, CEO, Nexa Advisory
Tim Buckley, Director, Climate Energy Finance
Azadeh Keshavarzmohammadian, Director, Deloitte Energy and Climate Advisory
Kirk McDonald, Project Manager, Supercharge Australia
Alan Pears, Senior Industry Fellow at RMIT University

Stakeholders consulted through research

Bill Gillespie, General Manager, Foton Mobility
Daniel Castro,President of Asia Pacific region, SEA Electric
Gareth Ridge, Country Director, Zenobe Energy
Helen Rowe, Transport Program Impact Manager, Climateworks Centre
Marion Terrill, Transport and Cities Program Director, Grattan Institute
Mark Dean, National Research and Planning Officer, Australian Manufacturing Workers' Union
Mick Neskes, National Relationship Manager, Custom Denning
Natalie Thompson, Senior Policy Manager, Electric Vehicle Council
Renae Lulham, Executive Assistant, Janus Electric

Peer Reviewers

Jake Whitehead, Policy Manager, Electric Vehicle Council
Dechen Dolker, Project Manager (Transport), Climateworks Centre
Mark Dean, National Research and Planning Officer, Australian Manufacturing Workers' Union
Matthew Pollard, Financial Analyst, Climate Energy Finance

Reviewers do not imply any endorsement of the content of this report.

Executive Summary

Commercial vehicles (CVs) currently contribute 9% of Australia's annual emissions and this is growing. To tackle these emissions in line with 1.5 degree celsius aligned Paris targets **we need 1.8 million zero-emission commercial vehicles in place of internal combustion engine (ICE) equivalents on our roads by 2030** (and more beyond that). While passenger electric vehicle (EV) deployment has received much attention, little has been done to address the deployment of CEVs such as trucks, buses, utes and vans.

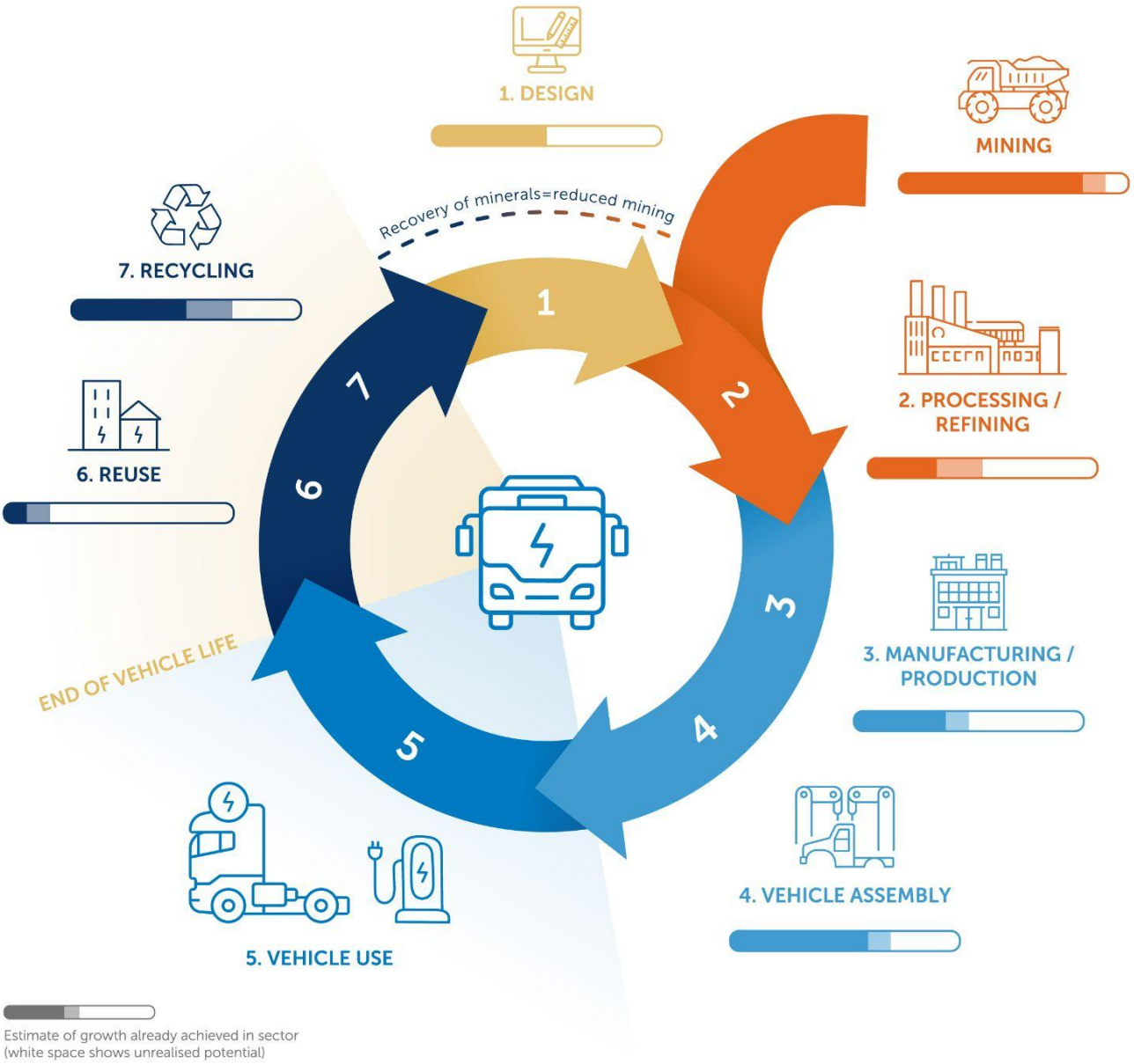
Australia has a healthy CV assembly industry and with the right support this can transition from assembling ICE buses and trucks to electric equivalents, in parallel existing commercial electric vehicle (CEV) manufacturers can expand production capability. **Growing eBus production three fold and eTruck production five fold would meet local demand and create 105,000 jobs with businesses benefiting from $110 billion in revenue by the end of 2030**.

As the global CEV manufacturing sector is in its infancy, Australia has the opportunity to embed itself in the global supply chain. Australia can be an appealing supplier to Asia, the USA and Europe with high environmental, social and governance (ESG) standards, and the opportunity to use low-cost renewable energy to create zero-emission components. There is significant potential for Australian manufacturers to meet domestic demand and grow export market capability if we act fast and scale our onshore manufacturing capability.

Australian companies are also taking steps to retrofit existing ICE CVs to electric. With 660,000 trucks currently on our roads and extensive fleets operating across our trading partners, **retrofitting is an industry innovation that can make a significant contribution to emission reductions and the growth of a circular economy.**

A commensurate policy response and government procurement targets are needed for CEV deployment to keep pace with global trends and meet domestic demand - with a future focus on capturing a share of international markets for zero-emission CEVs.

Australian Commercial Electric Vehicle Supply Chain



	Description of current growth and future opportunities
1. DESIGN	Local CEV designs available, designing for circular economy emerging
MINING/EXTRACTION	Established mining sector with relatively good ESG, zero-carbon approaches emerging
2. PROCESSING/REFINING	Established metals sector, battery mineral processing burgeoning
3. MANUFACTURING/PRODUCTION	Fragmented componentry sector (windows, detailing, body, electrical)
4. ASSEMBLY	Established truck and bus assembly (mainly ICE vehicles)
5. VEHICLE USE	NA
6. REUSE	Small amount of truck retrofitting (converting ICE to electric), emerging second-life battery industry
7. RECYCLING	Established metals recycling, burgeoning battery recycling

Recommendations

Recommendation 1: Set targets for

- **2030: All new commercial vehicle sales are zero emissions**
- **2030: Retrofit 20,000 ICE trucks to electric**
- **2040: All buses and trucks on Australian roads are zero-emission models**

This will address rising transport emissions by halving domestic CV emissions and paves the way for all buses and trucks in Australia to be zero emissions by 2040.

Recommendation 2: Consolidate sovereign CEV manufacturing industry, starting with the established assembly of trucks and buses, and scaling up light vehicles such as vans and utes over time.

2a. Introduce a production tax credit (PTC) for CEVs. For vehicles with less than 50% local content, offer a 15% PTC for new vehicles and 20% for retrofitted ones. For those with more than 50% local content, provide a 25% PTC for new vehicles and 30% for retrofitted ones

2b. Attract tomorrow's workforce today through a national communication plan.

Recommendation 3: Grow demand for CEVs to incentivise investment in and growth of the industry

3a. Repurpose the instant asset write-off for CEVs only.

3b. Introduce a tiered local content regulation policy.

3c. Secure a zero-emission government bus fleet declaration from state and territory governments and coordinate government bus procurement procedures across all levels of government.

Recommendation 4: Diversify and grow CEV supply chain capability in Australia through the zero-emission manufacturing of CEV parts, including batteries, bodies, electrics and glass and increase green steel and green aluminium production

4a. Establish a National Renewable Energy Industrial Precinct (REIP) program and encourage CEV original equipment manufacturers (OEMs) to set up production in REIP regions.

4b. Establish EV and battery testing facilities in Australia.

4c. Introduce manufacturing investment credit for equipment used to produce CEVs to grow local supply chains for componentry

Recommendation 5: Build a circular economy around the CEV industry

5a. Set industry design standards for new CEVs in consultation with groups such as the Zero Emission Vehicle National Innovation Council (ZEVNIC) to enable convenient future battery upgrades, and reuse and recycling of batteries and other components.

5b. Incentivise retrofitting of existing CEVs by enabling them to access the production tax credits for new vehicles.

See the recommendation section for more details

Introduction

Transport is responsible for roughly one-fifth of Australian greenhouse emissions (see Appendix 2), the majority of which come from road transport. By 2030, transport will overtake energy as the largest greenhouse gas emitting sector in Australia.

To address transport emissions, many countries are pursuing the rapid rollout of passenger Electric Vehicles (EVs) through strong policy settings and ambitious targets. European countries leading the way with EVs representing 88% of new car sales in Norway and 54% in Sweden[1]. In Australia, the National Electric Vehicle Strategy and upcoming Fuel Efficiency Standards are also primarily targeting passenger EVs. Increased EV supply and state policies have enabled an increase in sales from 2.4% of new car sales in 2021 to 8.4% in 2023[2].

While passenger cars dominate the transport sector by number, commercial vehicles (CVs) such as light commercial vehicles (LCVs; vans and utes), buses and trucks[3] make an equal contribution to emissions. Essential to moving large quantities of goods and people around the country and reliant on imported diesel, **CVs currently release 9% of Australian annual emissions (equal to 39 Mt CO2-e per year) and this is likely to increase to 12% (equal to 43 Mt CO2-e per year) by 2030 if no action is taken**[4]

There has been government investment in hydrogen and electric transport. While hydrogen models may play a role in the future of long-haul transport, electric models dominate the market locally and globally. Specific policies relating to the electrification of CVs is key to decarbonisation of the transport sector. Due to their large size and high use, each CEV that hits the road will result in a greater (per vehicle) reduction in emissions when compared to cars[5]:

- Electrifying 1 articulated truck is equivalent to replacing 42 cars
- Electrifying 1 bus OR 1 rigid truck is equivalent to replacing 6 cars
- Electrifying 1 LCV is equivalent to replacing 2 cars.

The time is now

While it is broadly acknowledged that Australia is unlikely to establish a competitive car manufacturing industry, our existing CV manufacturing and burgeoning CEV retrofit capability provides us with a headstart in the development of a CEV manufacturing industry. Australia's opportunity exists in its established supply chains for transition minerals, commodities and the assembly of buses and trucks, alongside a small but scaleable commercial model for the retrofit of existing trucks with batteries and electric drive trains.

Unlike passenger vehicles, global manufacturing capacity for CEVs is currently low. As demand for CEVs increases, global manufacturing capacity will follow suit. During this establishment phase, Australia has an opportunity to become a key player.

The USA and the European Union (EU) have both commenced policies to grow local manufacturing of CEVs and build onshore supply chains through the Inflation Reduction Act and the Green Deal respectively[6,7]. Similar drivers for our own manufacturers will ensure that Australia remains competitive and retains an industry that has stood the test of time.

Australia has the opportunity to support and scale an existing onshore manufacturing sector to meet domestic demand and grow a share in the emerging market for CEVs. We need to incentivise retooling, production, scaling of demand and supply chain diversification.

Keeping a focus on the future

The scale of battery capacity required to decarbonise freight trucks presents opportunities beyond long-haul goods transport. The alignment of the major eastern seaboard freight route with the National Energy Market, for example, could see the establishment of battery swap-out stations which could double as grid support services. Such stations paired with renewable energy could become the nation's largest distributed energy network. While not the focus of this report, any large scale mobile storage should be viewed as an opportunity to achieve greater energy productivity as we shift from multiple fuel sources to a more homogenised energy system.

Electric buses similarly offer a larger benefit than just replacing their counterparts. For example, mode shifting from individual use of passenger vehicles to public transport is critical in managing road congestion, particularly in urban centres. Both national and global trends toward more human-focused city centres and, more recently, suburbs see passenger vehicle access constrained in preference for walkable spaces and living or green infrastructure (trees and vegetated landscapes). While not covered in this paper, it is important to keep the long-term liveability of our cities and suburbs at the centre of forward-focused plans around human mobility.

The scale of opportunity

The International Energy Agency estimates a 10-fold increase in annual deployment of CEVs globally by 2030[8] (compared to 2022) - this would total 16.2 million CEVs added to the roads by 2030 from today. This increase in demand will cascade through the material supply chain and will amplify the global race to secure transition minerals and other materials [9]. A sustainable transport sector will require both new CEVs and the retrofit of existing fleets to manage resource inputs.

National commitments to domestic fleets are a key indicator of early demand. A recent study of international CEV (buses, trucks and vans) deployment pledges illustrates the potential opportunity if these pledges are realised (Figure 1). To demonstrate where Australia's ambition should lie, our 2022 Deploy report recommended that **in line with the 1.5 degree celsius Paris target[10], Australia needs to reduce emissions from domestic CVs by 50%; meeting this target will require the retrofit or replacement of 1.8 million CEVs by 2030 (on average 250,000 per year).**

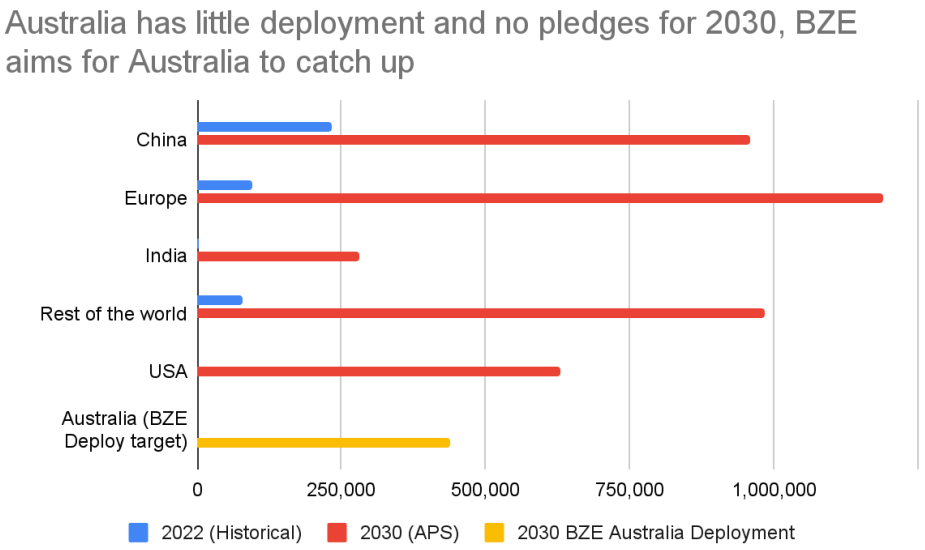


Figure 1: 2022 CEV annual sales and IEA 2030 Announced Pledge Scenario (annual sales) [11], alongside BZE report - Deploy CEV target for 2030[10]. Note: 2022 sales data unavailable for India, USA and Australia.

Australia currently has around a thousand CEVs on the road. To reduce our CV emissions by 50% by 2030, we need[10]:

- 1.5 Million eLCVs (utes and vans) - ramping up over time, averaging 223,000/year for the next 7 years
- 61,000 eBuses - ramping up over time, averaging 8,700/year for next 7 years
- 200,000 eTrucks (rigid and articulated) - ramping up over time, averaging 29,000/year for next 7 years.

Some countries have already started establishing their CEV fleet. Global sales (as a measure of deployment) took a major upturn in 2015 and 2016, and grew to 126,000 eBuses and eTrucks in 2022[8]:

- 66,000 electric buses were sold worldwide, representing about 4.5% of all bus sales (front runners Netherlands had electrified 27% of their bus fleet and China 26%)
- 60,000 electric trucks were sold worldwide, representing 1.2% of truck sales

(front runners China had electrified 1% of their truck fleet and Europe 0.2%).

There is an opportunity for Australia to decarbonise not only our own CV fleet but play a role in the decarbonisation of CVs beyond our borders**.** At present China accounts for the majority of the production of electric and hydrogen trucks and buses (~80-85% of global sales) - primarily for their own use; the majority of the rest are made in Europe and the USA[8]. China's dominance in CEV manufacturing is due to policies across the supply chain and across multiple levels of government over the past decade. With rapidly growing demand, there is opportunity for other countries to insert themselves in the supply chain[12].

As noted previously, the USA Inflation Reduction Act and the EU Green Deal aim to grow local manufacturing of CEVs and build onshore supply chains[6,7]. Australia has an opportunity to take similar steps to incentivise a domestic CEV manufacturing industry to keep pace with global trends and meet domestic demand. This would require a future focus on capturing a share of international markets for zero-emission CEVs, and in its absence, risks industry redomiciling. SEA Electric[13] is an Australian company that recently moved headquarters to Los Angeles, USA (they noted this was due to a lack of local policy support, large bank support and capital market appetite[14]).

Vehicle manufacturing opportunity

Australia has established bus and truck assembly capabilities for both ICE and electric CVs. Local manufacturers currently produce a low number of CEVs but have the capacity to produce more if demand increases[15]. Refocusing bus manufacturing to exclusively manufacture eBuses, **would require a three fold increase in current production to meet eBus targets** (Table 1). If all existing truck manufacturers were focused on eTrucks, we would only **need a five fold increase to meet eTruck targets** (Table 1).

Light commercial vehicle manufacturing is a mix of assembly and retrofits, and is occurring on a very small scale compared to the number sold each year. Focusing on scaling our existing capability in the manufacture of trucks and buses should be our immediate priority in decarbonising CV fleets.

	CEVs on Australian roads (2022)*	CV production (2022)*	CV sales* (2022)	Average annual CEV deployment target (between 2022 and 2030)	Total Deployment target for CEV (2022 to 2030)
LCV	100+[16]	2,500	256,000[17]	214,000	1.5 Million
Bus	200-300[18]	1,300 (EV production capability - 2,900)*	4,250[19,20]	8,700	61,000
Trucks	200-400	6077[21]	38,860[22]	29,000	200,000

Table 1: Comparing existing deployment of CEVs, current production and sales of CVs (both ICE and electric - majority of both being ICE vehicles) with 'demand' as outlined by the 2022 Deploy report.

**SOURCE: eLCV data is based on recent sales and may be higher, eTruck data is based on stakeholder interviews and also may be higher; the EVC is calling for funding to enable better CEV data.*

There have been recent changes to truck width regulations however industry bodies are still calling for governments to consider changes to other regulations such as weight limits; this would provide greater market certainty for the building of electric trucks at local facilities[23].

Retrofit opportunity

Converting existing CVs to electric, specifically trucks (typically older, less efficient and more polluting) offers a huge opportunity to reuse capital expenditure. It also optimises the use of existing embodied carbon and defers the embodied emissions in new vehicle production. Truck engines must be replaced every 1 million kilometres - this milestone provides an opportunity to retrofit them with an electric motor and battery. Currently Australia has 660,000 trucks on our roads, of which there are 104,000 prime movers that are known to be viable for retrofitting.

Existing retrofit capacity in Australia is low and significant investment would be required to scale up operations. However, **'reuse' of existing vehicles is a smarter, more cost effective and less wasteful approach to getting CEVs on the road.**

Supply chain opportunity

Scaling-up the assembly of eBuses and eTrucks onshore and encouraging retrofits would also create demand for and opportunities to grow component manufacturing capability along the supply chain. We already have local supply chains for components such as body structures, detailing, windows and electrical components (see Table 2). **Given increases in global demand for CEVs, there is an opportunity to scale local operations to be part of local and the global supply that is currently being established.**

Job opportunity

The EU predicts that EV manufacturing will lead to major job growth, with up to 4 million battery-related jobs created by 2025[24]. EVs will require new or retooled factories, each requiring thousands of employees, and the retraining of staff[25,26]. It is difficult to assess how many will be new hires versus existing workers who are retrained. However, it is clear that **growing the local industry across the supply chain will create jobs in mining, processing, manufacturing, assembly, sales, maintenance/repair and circular economy.**

Australia's existing automotive industry to build from

Since the closure of the Holden, Toyota and Ford manufacturing plants in the 2010s, Australia's vehicle manufacturing industry has become fragmented[27]. While there are no longer manufacturing facilities for conventional passenger vehicles in Australia, bus and truck manufacturers and their supply chains have retained a foothold. **Our automotive industry workforce (34,000) is currently equivalent to that of the coal mining industry and is well-positioned to pivot to support the growth of CEV manufacturing onshore.**

Australian-Made, new CEVs

Australian manufacturers are making vehicles for local roads, conditions and regulations, and include both established brands and startup companies. According to the bus and truck industry bodies, Australia is currently producing 1,300 buses per year (with an industry

contribution to the economy of $5 billion per year), and 6,000 trucks per year [28], see Table 1 above. Only a small portion of these are currently electric. Local bus manufacturers are producing a mix of ICE *and* electric models, whereas truck manufacturers typically produce either ICE *or* electric.

Local manufacturers who are working in the CEV sector include:

- eLCV: EV Automotive, GBAuto, ROEV, SEA Electric, Voltra, Zero Automotive
- eBuses: BCI, Bus Tech Group, Custom Denning, Nextport, SEA Electric, Volgren Australia, Zemtec, Volvo Australia
- eTrucks: Janus Electric, SEA electric, Volvo Australia.

Of the 50 CEV models available in Australia in 2023, 23 (46%) are made onshore[2]:

- eLCV: 6 out of 17 available models are made here
- eBuses: 12 out of 21 available models are made here
- eTrucks: 7 out of 12 available models are made here.

Australian-made electric trucks - SEA Electric

SEA Electric launched its first proprietary electric power-system technology for urban delivery and distribution fleets in 2017. It has since released multiple medium and commercial EV models with applications including delivery trucks, garbage trucks, tipper trucks, school and shuttle buses, plus cargo and passenger vans.

Founded in Australia in 2012, SEA Electric is now headquartered in Los Angeles serving markets in the US, Canada, Australia, New Zealand, Asia and the EU, with numerous collaborations ongoing with leading original equipment manufacturers (OEMs) and business fleets.

SEA Electric's Australian facility has commenced 100% Australian production of electric trucks supported by a national SEA Electric dealer network. They have the capacity to manufacture around 500 electric trucks per year, employing 50 staff.

Australian-made electric buses - Custom Denning

Custom Denning is Australia's oldest bus builder and their vision is to become Australia's leading manufacturer of buses for the Australasian passenger transport sector. Their electric bus model has a battery capacity of 378 kWh and a range of 500 km, double that of the majority of imported models. Around 65-70% of parts come from local businesses. They have 250 employees and are making 200 e-buses per year with a capacity to manufacture 500 per year.

Retrofitting CVs

CVs contain large amounts of materials and resources and have long product lives, the average age of an Australian truck is 14 years[29]. Retrofitting ICE trucks, buses and LCVs with zero-emission technologies (mainly electric) is growing internationally - the EU and the UK are also driving retrofitting as an approach to meet transport emissions targets[30,31].

Retrofitting has many benefits over producing new vehicles, such as saving cost, waste and carbon emissions through the reduction of supply chain steps in the delivery of a complete CEV. Unlike the challenges with converting cars[32], CVs typically have more accessible powertrains and drive chains and the body and chassis are more valuable making CV retrofit simpler and more commercially viable.

Vehicle retrofit is a relatively new industry, which would benefit from further research and development, but Australia has companies such as Janus Electric already working in this space.

Retrofitting is key - a case study

Janus Electric is an Australian company founded in 2018 off the back of ground-breaking battery technology to electrify road fleet transport. The company retrofits existing trucks that are over 10 years old with their all-electric technology. The conversion uses an exchangeable battery system with a range of 600 km that can be swapped over in four minutes. Trucks are converted when they are due for an engine rebuild/replacement, and the electric conversion costs a similar amount to the rebuild. Janus reports that its retrofitted electric trucks run at one-third of the cost of diesel vehicles per kilometre.

The exchangeable batteries used in these trucks enable charging to be done when low-cost, renewable energy is available. These change-and-charge battery stations are very flexible and can charge: grid to battery; battery to battery; and battery to grid. In addition, as new battery technologies come onto the market, they can be used in these systems too for immediate benefits such as additional range and battery capacity.

Janus currently has 40 employees and as such their current capability is small. However, their vision is for significant growth both in Australia and the USA, and they are currently establishing a network of dealerships across Australia who will convert Class 8 Prime Movers for fleets to minimise downtime and freight overheads.

Local vehicle components

At present Australia's bus and truck manufacturing is predominantly focused on assembly, with components coming from both on and offshore. Supply chain components that are already being manufactured onshore include windows and detailing, a large proportion of the body and an increasing amount of electrical components. In general, chassis, drive trains and batteries are being imported (see Table 2).

Component type	Local components	Imported components
Battery and electric motor/drive chain	Gap/Opportunity	Majority
Chassis (skeleton)	10%	90%
Electrical components/wiring	40%	60%
Body (superstructure)	70%	30%
Detailing and windows	Majority	Low

Table 2: Source of CV/CEV components for assembly in Australia

Skilled workforce

Australia's motor vehicle manufacturing industry currently employs around 34,000 people[33]. This existing, skilled workforce is a strong base from which to grow onshore CEV manufacturing:

- 85% of employment is in parts manufacturing which includes body and trailer manufacturing (largely focused on buses, trucks and ute trays, electrical components and other parts).
- 15% of employment is in motor vehicle manufacturing - this is largely focused on assembly. There are fewer jobs in this area, even though it is a major focus of activity.

Post the COVID-19 pandemic, the automotive sector reported a shortage of workers across manufacturing, servicing and repair[34]. **There is a shortfall of 70,000 employees between the number of current employees and the workforce that would be required to build trucks and buses at the targeted deployment rates onshore.** To address these shortages and service a new electrified industry, the provision of appropriate training and upskilling is imperative. The Canberra Institute of Technology is currently leading the way with retraining courses for mechanics and a dedicated centre, and the Victorian government has opened a new EV laboratory to address job shortages in the state [35,36].

CEV materials

By weight, the primary material in a CEV is iron and steel followed by battery minerals (Figure 2). However, battery minerals have the highest cost.

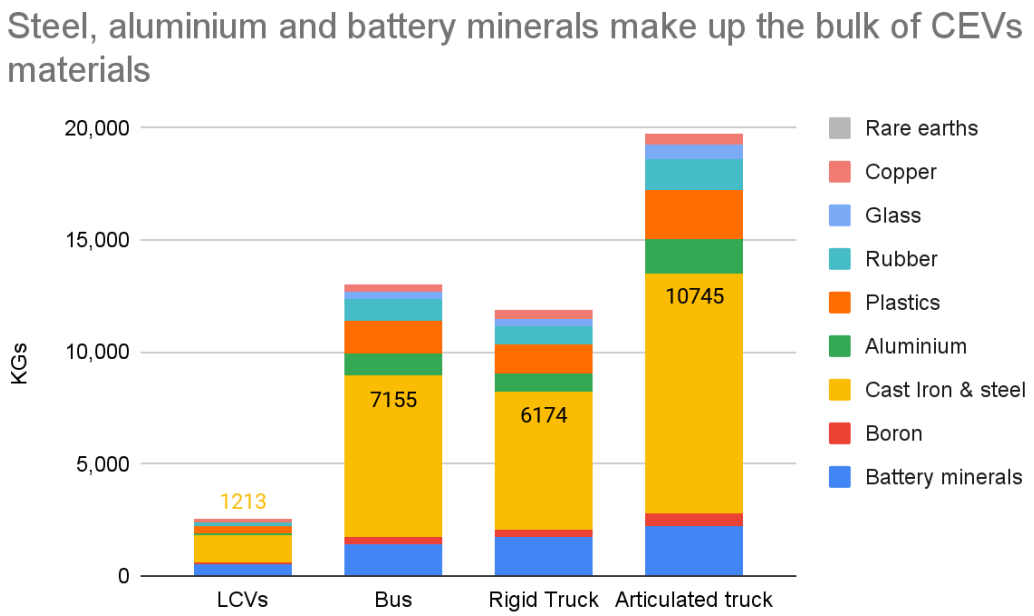


Figure 2: Materials by weight in CEVs. Battery minerals include lithium, cobalt, nickel, graphite, copper, manganese - plus iron, steel and aluminium

The total amount of materials needed to build the 1.8 million CEVs (required to meet 2030 1.5 degree celsius target[10]) and the 16.2 million CEVs (in the pledge announced by the International Energy Agency) are shown in Figure 3 below. At a high level, Australia has sufficient material reserves to meet the demand for all of these (with the exception of plastics and rubber). This data also highlights the value of retrofitting existing vehicles over the manufacture of new CEVs with virgin materials.

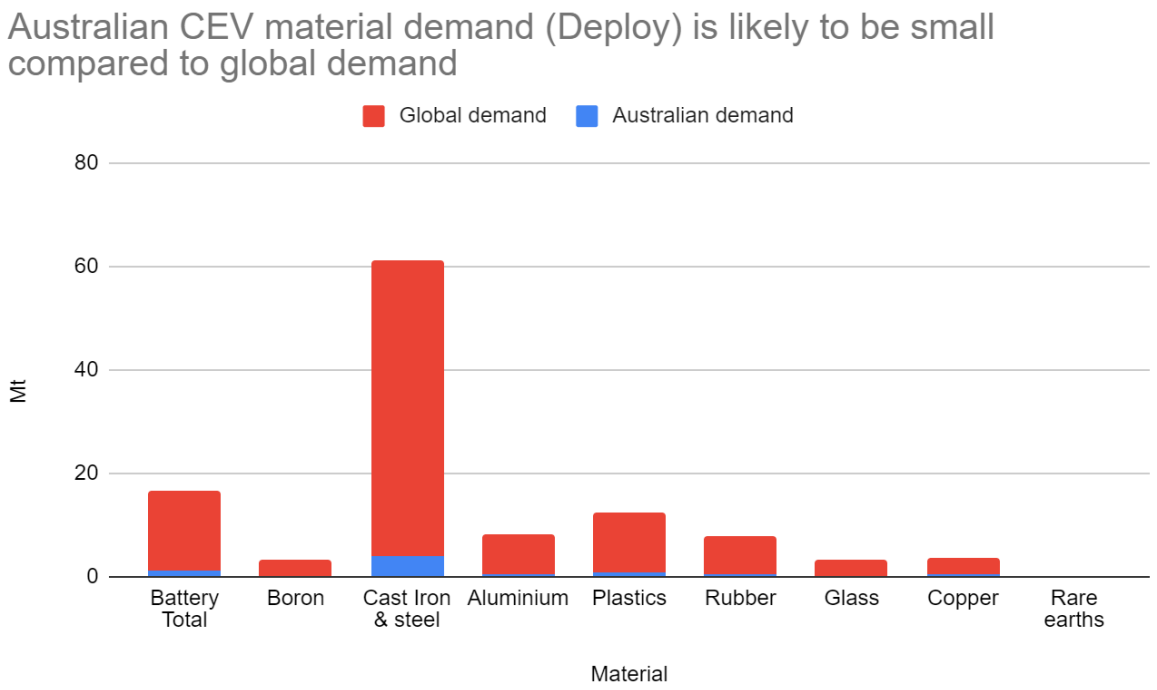


Figure 3: Total material requirements for the manufacture of CEVs using IEA data[8] for global demand and BZEs Deploy[10] target for Australian demand between 2023 and 2030

The growth of an onshore CEV industry can provide increased demand for green commodities (notably steel and aluminium) and manufactured goods including batteries. As the industry scales, linkages with these industries can provide offtake and develop opportunities to diversify the supply chain with Australian manufactured components. Local content incentives and design standards can progressively support local and zero-emission content to decarbonise the entire supply chain over time.

Circular economy

It is important that we apply circular economy principles to the CEV industry as it becomes established, for example:

- **Reduce** - retrofitting reduces material use compared to building new CEVs; transportation mode shifting reduces emissions by removing the number of vehicles on the road; we can also look to design better material efficiency as part of the CEV supply chain.
- **Reuse** - retrofitting reuses existing CVs; repurposing identifies a second life for CEV components, for example, CEV batteries maintain a productive life over 10 years - when they drop below a certain efficiency they can be used for stationary energy, gaining an additional 3-4 years of service life after vehicle use (see case study below). 100% of CEV batteries can be reused and overseas, these batteries are redeployed at locations including bus depots to further decarbonise the transport sector.
- **Recycle** - The majority of materials in CEVs are highly recyclable (see Appendix 3). The Auto Parts Recyclers Association of Australia estimated the value of the industry at $1B in 2019[37]. Programs like 'Retire Your Ride' already offer a national end-of-life vehicle scrappage program dedicated to using auto recyclers who comply with industry standard environmental guidelines[38].

Design standards have a key role to play in enabling the circular economy and are central to interoperability, reuse and recycling. For example, standardising the design of CEV battery bays, modular battery design and interoperability of batteries between vehicles is essential. This will ensure that all battery technologies fit in the battery bay while maintaining vehicle balance and that existing vehicles can benefit from new battery technologies over their lifespan (eBus bodies last for 20+ years and batteries need to be replaced every 8 years[39]). The EU is developing a circular economy policy aimed at measures to enhance the circularity of the automotive sector, covering the design, production and end-of-life treatment of vehicles[40].

Zenobe and second-life batteries for electric buses

Zenobe started in 2017 in the UK and expanded to Australia in 2020. Their business model focuses on end-to-end bus fleet management, with a focus on electric buses. They help to remove the financial, technical and operational risks of the energy transition by managing finance, charging infrastructure (including upgrades) and software.

Recently, they helped to deliver Australia's largest electric bus project, in the Leichhardt (Sydney) depot, housing Australia's largest single fleet of 59 electric buses. The site has stationary batteries* installed that enable charging when energy is cheapest to buy and discharging when the site can sell energy back.

Their model prolongs the use of EV batteries by repurposing them in stationary uses like bus depots or other commercial sites. This can increase the life of batteries by up to 50%. This also buys more time for the recycling industry to mature.

*Zenobe has used 2nd-life EV batteries on UK sites but due to a lack of commercial EVs in Australia, very few batteries have been retired from CEV to redeploy for stationary energy. As the development of electric transport increases in Australia, Zenobe hopes to be able to repurpose EV batteries in Australia.

Infrabuild - Steel recyclers

Infrabuild are steel recyclers that have been operating for over 100 years. They currently employ more than 4,700 people across 35 recycling sites across Australia. They recycle 1.4mt of steel per year, capturing 98% of metals in the recycling stream. They can eliminate 76% of their combined Scope 1 and 2 emissions by transitioning to renewable electricity. They are committed to becoming a net-zero (carbon-neutral) steel manufacturing business by 2030.

Zero-emission CEVs

The CEV industry has opportunities in both retrofitting existing CVs and manufacturing new CEVs - but the ultimate goal must be to decarbonise the whole vehicle life cycle, creating zero-emission vehicles with zero embedded emissions. **Given Australia's natural advantage in solar and wind resources, we are well-positioned to become leaders in zero-emission manufacturing of CEVs and their supply chains.**

In 2018, the automotive manufacturing industry created 9% of global emissions[41]. Emissions from manufacturing EVs vary widely across different locations and producer's grid emission intensity. The IEA estimates EV can create a quarter more emissions than an equivalent ICE vehicle due to the additional energy required for battery mining and manufacturing[42]. Emissions are released through:

- raw materials being mined, refined, processed and transported
- manufacture of parts, their transport and final assembly.

Using current approaches to manufacture:

- 1.8 million CEVs, (Deploy target[10]), would release ~30.4 MtCO2e (approximately 1% of Australia's emissions over the period to the end of 2030)
- 16.2 million CEVs, as detailed in the global pledges announced by the IEA, would release ~418 MtCO2e [42].

While these numbers are relatively small, tackling emissions in the CEV manufacturing supply chain will be paramount to maintaining competitiveness in growing global markets (and will have an impact on global emissions), particularly beyond 2030 as nations accelerate their move toward net zero emissions.

From an international trade perspective, the materials used across the CEV supply chain, notably transition minerals, steel and aluminium are in increasing demand. **Decarbonising the mining, processing and manufacture of these materials will increase their value and the competitiveness of Australian manufactured goods**[43]as policies such as the Inflation Reduction Act in the USA and the European Green Deal demand increasing proportions of zero-emission components in EVs.

The EU is leading the way in reducing automotive manufacturing emissions and has achieved a 46% drop since 2006[44]. Australia has an opportunity to follow suit and commence modernising our current CV/CEV manufacturing and supply chain to zero emissions. In doing so, products will be 'green' and their value will increase both on and offshore [43]. Renewable Energy Industrial Precincts (REIPs - see explainer box) are a key enabler for this, providing access to large amounts of low-cost renewable energy in areas of existing infrastructure.

Renewable Energy Industrial Precincts

Renewable Energy Industrial Precincts (REIPs) are an efficient way to revitalise our industrial centres with low-cost renewable energy to power the industries of the future. They are clusters of energy-intensive manufacturing facilities in one location, powered by 100% renewable energy and connected to each other using modern energy management tools. This proposed model minimises the cost of shared infrastructure and allows manufacturers to benefit from economies of scale and efficiencies. Ideally, REIPs should be located in existing industrial centres to benefit from the skilled workforces, ports and road, rail and energy infrastructure.

REIPs need good renewable energy resources and access to green hydrogen production and clean heat. REIPS will enable the low-carbon goods of the new economy. They can support energy-intensive businesses such as green aluminium and steel, hydrogen, ammonia and chemicals production, recycling and battery manufacturing, which means a REIP model would work best in our regional manufacturing heartlands. REIPs can also provide a home for manufacturers of the large amounts of clean technologies we need to deploy, such as wind turbines, electric vehicle chargers, batteries, electrolysers, electric buses and mining equipment, boosting manufacturing in Australia.
Many organisations are calling for the REIPs including WWF and Climateworks Centre.

Recommendations and reaping the rewards

Australia has a significant opportunity to grow a burgeoning industry in the manufacture and assembly of electric buses and trucks. With the right support, we can not only maintain but grow an industry. As domestic and global markets decarbonise and global manufacturing of CEVs is in an establishment phase - this is a time-critical moment. We have an opportunity right now to support our existing CV industry to remain competitive, and can seize the opportunity to diversify our supply chain participation in CEV components and scale up eBus and eTruck assembly. This offers sovereign security too, ensuring we have access to enough CEVs to keep people and goods moving while also decarbonising our transport sector.

The CV retrofit market also represents a significant opportunity, through its ability to decarbonise existing vehicles with long life cycles on the one hand, and on the other hand its potential to push economies of scale in adjacent industries including battery manufacturing (battery supply chains will be addressed in a forthcoming BZE release).

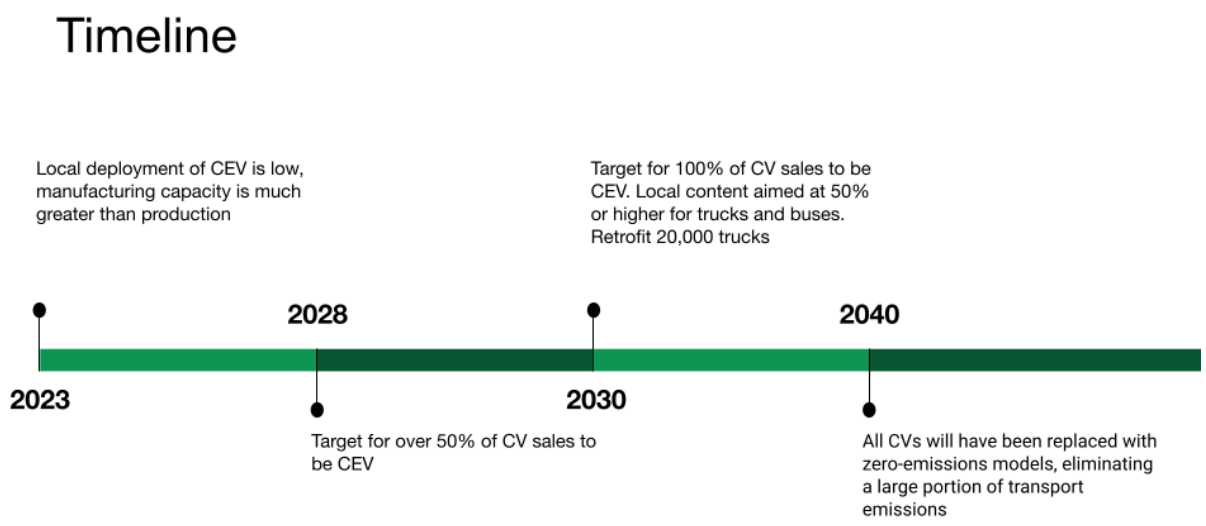


Figure 4. Paper recommendations on a timeline to 2040.

Recommendation 1: Set targets for

- **2030: All new commercial vehicle sales are zero emissions**
- **2030: Retrofit 20,000 ICE trucks to electric**
- **2040: All buses and trucks on Australian roads are zero-emission models**

To meet emission reduction targets we need to deploy or retrofit 1.8 million zero-emission CVs over the next seven years, including 300,000 buses and trucks. Vehicles with larger emissions and more kilometres travelled such as buses and trucks should be targeted first. Benefits include:

- 50% reduction in transport emissions (in line with 1.5 degree celsius Paris targets)
- $50.5 billion overall net revenue to government and society in 2030, according to a model by the Electric Vehicle Council[45]], and health savings equivalent to $77.5 billion to the annual economy by 2030 according to a University of Melbourne position statement[46].

Enabling policy:

Set a target of 100% of new commercial vehicle sales to be zero emissions by 2030 within the Transport and Infrastructure Net Zero Roadmap and Action Plan[47]. Four Australian states and territories (NSW, VIC, SA and ACT) have already committed to the Glasgow Declaration on Clean Commercial Vehicles [48]. This declaration establishes an interim goal for 30% of new commercial vehicles to be zero-emission by 2030, increasing to 100% by 2040. Federally we have yet to officially announce or establish a specific target for CEV adoption. We believe there is room to be far more ambitious with the rollout of CEVs and recommend setting a national target for commercial electric vehicles within the Transport and Infrastructure Net Zero Roadmap and Action Plan[47]. For 100% of new commercial vehicle sales to be zero-emission by 2030, it is recommended that the Action Plan adopt biannual targets to track progress and allow for incentives to be reviewed for their impact.

Benchmark: By 2030, Norway aims to have 100% of new light commercial vehicle sales, including larger vans, be zero emission. Additionally, the target for heavy commercial vehicles is for 75% of new long-distance buses and 50% of new trucks to be zero-emission[49].

Recommendation 2: Consolidate sovereign CEV manufacturing industry

Grow our existing CV capacity by converting ICE manufacturers to electric and building on CEV manufacturing strengths. This should focus on the established assembly of trucks and buses, with the aim to build 200,000 new eTrucks and 61,000 eBuses by 2030 (on average 38,000 a year). This is just under double our current manufacturing capacity. Given the 9 current sites with an average capability of making almost 6,000 trucks and buses a year, this will require 90 new or converted manufacturing sites to achieve this output and benefits include:

- jobs for around 105,000 people across industrial hubs throughout Australia
- an estimated $110 billion in revenue from CEV sales by the end of 2030.

There is a huge demand for eLCVs and the government could consider investment to establish this subsector. Supporting the existing bus and truck industry enables the prospect of diversification into eLCVs manufacturing.

Enabling policies

2a. Introduce a Production Tax Credit (PTC) for the manufacture of new CEVs and the retrofitting of existing CVs. This would incentivise Original Equipment Manufacturers (OEMs) to produce more CEVs and bolster the retrofit industry. It would also ensure that Australia secures a supply of CEVs, and make retrofitting more cost-effective for businesses aiming to convert their existing fleets to CEVs.

- For new vehicles, we propose a PTC of 15% of the value of the vehicle for manufacturers with less than 50% local content and a PTC of 25% for those with more than 50% local content.
- For retrofitted vehicles, we propose a PTC of 20% for EV componentry with less than 50% local content and a PTC of 30% for EV componentry with more than 50% local content.

Benchmark: US Inflation Reduction Act, Commercial Clean Vehicle Credit[47].

2b. Attract tomorrow's workforce today through a national communication plan. The shortage of skilled workers was one of the key recurring pain points identified during our industry stakeholder engagement.

Investment in the development of nationally recognised courses to keep pace with this rapidly evolving industry. While the government has taken steps to address this through the development of training packages and qualifications such as the AUR32721 Cert III in Automotive Electric Vehicle Technology[50], which is available through technical institutes and TAFE, more needs to be done to ensure a sustainable influx of talent into this industry.

Industry engagement undertaken by BZE highlights the need to ensure that school leavers and the community more broadly are aware of the employment opportunities as industry scales. We recommend that the government develop a national communication strategy to engage school leavers and those looking for a career in the electric automotive industry to

create awareness of the career paths available. We recommend that this be part of a broader "**Make Australia Make Again**"[51] style national program across job opportunities in the cleantech sector, especially in the key technologies specified in our 2022 Deploy report[10], (electric vehicles, battery energy storage, heat pumps, solar, wind and electrolysers). This will allow the government to showcase the job opportunities available not just in the CEV space but also in the wider energy transition. Key to the success of the Plan will be actions focused on ensuring equity and access across broad sections of the community, particularly those in regions impacted by the transition, First Nations Communities and communities with high unemployment.

Recommendation 3: Grow demand for CEVs

To help meet targets set in Recommendation 1, and provide a market for scaling local supply chains and assembly as laid out in Recommendation 4 and 2 respectively, there is a need to incentivise and increase domestic demand for CEVs (and build a network of users and businesses as champions of the economic benefits):

- Trucks and LCVs - need to become cost competitive in the short term
- Buses - federal coordination with state and territory governments needs to establish and deliver eBus targets.

Enabling policies

3a. Repurpose the instant asset write-off for CEVs. The instant asset write-off[52] was introduced in 2011 enabling the write-off of the full amount spent on an asset (used for business purposes, such as a vehicle) in the financial year it was purchased, enabling the tax deduction of the full cost of the asset. It was originally limited to $1,000 per asset and in October 2020 increased to $150,000 and as of June 2023 has been reduced to $20,000[53]. To accelerate the adoption of CEVs in Australia, we propose that the federal government revise the instant asset write-off scheme for new CEVs. This would allow businesses with turnovers of less than $50 million to write off up to :

- $150,000 for zero-emission rigid trucks and buses until 2030, and
- $250,000 for zero-emission articulate/prime mover trucks until 2030.

This would aid businesses in bridging the "green gap" – the cost difference between a CEV and a traditional ICE heavy vehicle – making CEVs more affordable and accessible. Note: The cost of zero-emissions CEVs is likely to be higher than the claimable tax threshold and this should not be a cap.

Benchmark: Repurposing of an existing Australian Government tax incentive [53].

3b. Introduce a tiered local content regulation policy, with incentives that grow in tandem with increased local content. We have the opportunity to incentivise local production and also to secure greater local participation in the CEV supply chain as the Australian industry expands to its full potential. We propose that the government, in consultation with the ZEVNIC group, determine the makeup of this tiered policy[54] . The ZEVNIC includes broad participation across industry, unions and research and can help to develop local content requirements that are in line with local industry capability and ambition.

Benchmark: Build America, Buy America Act[55], Brazil's local content policy for the renewable energy sector[56].

3c. Secure a zero-emission government bus fleet declaration from state and territory governments and coordinate government bus procurement procedures across all levels of government. We propose that the federal government in consultation with all states and territories implement procurement policies to accelerate the electrification of bus fleets. This could be achieved through the Energy and Climate Change Ministerial Council. We recommend

- a target for all government bus purchases to be electrified by 2030.

- a percentage-based target for Australian manufactured buses that increase as the industry scales and that prioritises manufacturers with greater local content in order to incentivise manufacturers to move beyond assembly to component manufacturing.
- coordinating purchasing agreements across government contracts to provide steady demand to local manufacturers to assist in scaling the industry. This unified approach will reduce inter-state competition in procurement processes and allow Australian manufacturers to meet a greater proportion of governments' fleet requirements.

Benchmark: Globally, 27 governments have pledged for 100% of bus and truck sales to CEV by 2040.[57]

Recommendation 4: Diversify and grow CEV supply chain capability in Australia

Zero-emission components, including batteries, bodies, electrics, glass, steel and aluminium are set to become hallmarks of future CEV markets. Australia already has strengths in CV body structures, detailing, windows and electrical components; coordinated investment in onshore capacity across these commodities will secure a greater share of CEV supply chains while creating a greater value proposition for Australian manufactured CEV in global low carbon markets.

Industrial ecosystem approaches (where facilities are collocated and or linked through coordinating bodies) paired with renewable energy supply can accelerate the development of zero-carbon integrated supply chains. The REIP model advocated by BZE and others (see page 16) provides such a place-based model which will attract and coordinate emerging industries around existing infrastructure and industry as well as skills and centres of innovation. Encouraging industry players to colocate within existing industrial regions can encourage greater collaboration along the supply chain, while providing renewable energy access to decarbonise operations. Recent research by BZE, *Safeguarding our Future,* demonstrated the additional economic benefits and emission reductions that can be achieved through such coordinated investment, notably the delivery of economies of scale for common user infrastructure.

Enabling policies

4a Establish a National Renewable Energy Industrial Precinct (REIP) program and encourage CEV OEMs to set up production in REIP regions and integrate their supply chains. By focusing on the integration of CEV supply chains in these areas, manufacturers can leverage extensive infrastructure, including roads, rail freight and easily accessible ports, as well as access to renewable energy for manufacturing and research and development for product design and innovation. This approach fosters the growth of interconnected local industries and the potential to achieve economies of scale through the agglomeration of demand both within the industry and with other industries requiring similar inputs.

The development of a manufacturing ecosystem that connects Australian innovation to commercial manufacturing has been elusive to date with this disconnect seeing innovation commercialised offshore. Integrated manufacturing hubs strengthen connections between research and development, testing and commercialisation.

4b Establish EV and battery testing facilities in Australia. EV and battery testing facilities are critical to the growth of our domestic CEV industry and act to streamline research and development processes, expedite product testing, and see new models reach the market more swiftly. The location of testing facilities within REIP alongside battery testing facilities can see REIP regions become centres of excellence in design, with rapid testing cycles that can accelerate the timeline between innovation and commercialisation.

4c Manufacturing investment credit for equipment used to produce CEVs to grow local supply chains for componentry.

To capture Australia's CEV opportunity, retooling or establishing manufacturing capability along the supply chain will need to be incentivised in the short term to encourage industry diversification. Tax credits aimed at reducing the cost of the purchase of manufacturing plants and equipment to produce CEV components such as batteries, chassis, cables etc, have been used in Australia in various forms and in other jurisdictions such as Canada to build similar capability in the passenger EV market. The benefit of providing a tax credit for equipment rather than finished goods is that they incentivise the establishment of new capability, which in many cases has benefits beyond the use of the initial industry targeted.

We recommend that a manufacturing investment credit of

- 20% be applied to all equipment and machinery used in producing componentry across the CEV supply chain
- 25% be applied to the establishment of CEV retrofit facilities.

This is designed to work in conjunction with current tax incentives for early stage innovation companies (ESIC) under the National Innovation and Science Agenda (NISA), which provides a 20% non refundable carry forward tax offset on amounts invested in qualifying ESICs [58]. Together these initiatives will help to drive greater participation in the CEV manufacturing supply chain and derisk private investment.

Benchmark: Canada Clean Technology Manufacturing Investment Tax provides a refundable tax credit of 30% of capital investment in equipment and machinery used to manufacture EVs and to extract and process the critical minerals used in EV production.

Batteries are around 60% of CEV production cost. Charging Ahead 2023, a report by the Future Battery Industries CRC, showed the importance of developing an Australian diversified battery industry that will enable servicing of the CV sector [59]. They reported:

- More zero-emission mining is required to access battery minerals and more zero-emission onshore processing of battery minerals is also essential
- There is an opportunity for the battery industry to contribute $17billion to the Australian economy and creation of 61K direct jobs by 2030

Benchmark: US Inflation Reduction Act, American Battery Materials Initiative [60].

Beyond Zero Emissions' forthcoming paper on battery supply chains will delve deeper into this topic.

Recommendation 5: Build a circular economy around the CEV industry

The development of a CEV circular economy will maximise the reuse of materials used in the manufacture of CEVs. We recommend a circular economy policy that includes:

- Scaling onshore retrofitting - converting **20,000** older, existing articulated (ICE) trucks to electric by 2030 will:
    - circumvent the production of at least 120,000 t $CO_{2\text{-}e}$ embodied emissions
    - target trucks built to lower emissions standards and thereby maximise reduction of emissions and pollutants
    - BZE has calculated this will require 80 sites and benefits include jobs for around 20,000 people and creation of an estimated $3.5 billion in revenue by the end of 2030.
- Reuse of batteries - developing pathways for second life applications, notably for stationary energy before ultimately recycling; for example reusing 60,000 batteries from retiring buses between now and 2030 will:
    - circumvent the production of at least 1,077,799 $tCO_{2\text{-}e}$ in embodied emissions
    - circumvent the mining of 85 Mt of battery minerals that would have been created if new batteries were made
    - provide up to 1291 MW and 2583 MWh of storage capacity
- recycling retired CVs, bodies and batteries at end of life - growing the number of onshore zero-emission recycling plants to manage these materials and ensuring standards align for both designing for disassembly and for reuse of recovered resources, offering further job and business opportunities.

Enabling policies

5a Set industry design standards to enable interoperability and reuse of batteries and subsequent recycling opportunities. Establish industry design standards, such as a standardised battery bay configuration and common design for battery connectors, through the ZEVNIC. A standardised approach to battery connectors will enable existing and new CEVs to easily swap in new batteries when the old ones become obsolete. Additionally, it will facilitate the retrofitting of newer and upcoming battery technologies that have higher energy densities, shorter charge times, and longer lifespans, ensuring seamless integration. Standardised battery bay configuration will ensure that new battery technologies are provided with design criteria that maximise the potential for interoperability.

5b Incentivise retrofitting of existing CEVs. Retrofitting is a key piece of the puzzle to accelerate the transition to a zero emission transport industry. CEVs currently on the road will require an engine rebuild in their life cycle and this represents a key opportunity to transition the vehicle to electric operations. As outlined above, we make two recommendations to incentivise the electrification of existing CEVs:

- **Production tax credits.** As underlined in the enabling policy 2a above, we recommend that the government incentivise retrofitting of existing ICE vehicles into zero-emission vehicles by introducing a production tax credit for retrofits. We suggest

a PTC of 20% for vehicles with less than 50% local content and a PTC of 30% for vehicles with more than 50% local content.

- **Manufacturing investment credit.** As outlined in section 4c above, we recommend that a tax credit of 25% be applied to the establishment of CEV retrofit facilities.

Benchmark: The EU's automotive circular economy policy improving design, recycling and recovery of materials [40]

Appendix 1: Overview of Commercial Electric Vehicles

Commercial Electric Vehicles (CEVs) are electric-powered vehicles designed to transport heavy loads and perform tasks that require higher power and torque. They are typically used for non-personal transport and include:

- **light commercial vehicles** e.g. utes and vans - driving ranges of 800 km available
- **buses** (more than 8 seats) - driving ranges of 500 km are available [2]. Australian models offer double the range of imported models; as a mode of public transport they also decrease private vehicle use and tackle congestion[2]
- **trucks** (more than 3.5 tonnes) - driving ranges of 600 km are available with batteries that can be swapped out within three minutes.

CEVs can be built not just for distance but also to carry loads while withstanding tough terrain; for example, electric mining and electric military vehicles (these are however not included in the scope of this work).

Weighty vehicles

eTrucks weigh more than their Internal Combustion Engine (ICE) counterparts. While manufacturers produce eTrucks of all sizes, there are currently more light and medium-duty models available. As innovation in material use and battery chemistry continues to drive better power-to-weight ratios, eTruck weights are decreasing and major truck manufacturers are increasing the number of commercial models[8].

CEVs cost less to run - and so much more

Aside from lower emissions, CEVs are cheaper to run than ICE equivalents - the Electric Vehicle Council estimates that eTrucks are around $30 cheaper per 100km[61] . In addition, they also:

- have fewer moving parts and require less maintenance
- are more reliable and efficient
- create less noise and vibrations
- are safer for drivers and cause fewer road accident deaths[62]
- produce less air pollution, in particular particulate matter.[46]
- offer disproportionate fuel savings in congested traffic or when doing multiple deliveries; this is amplified when CVs are refrigerated.

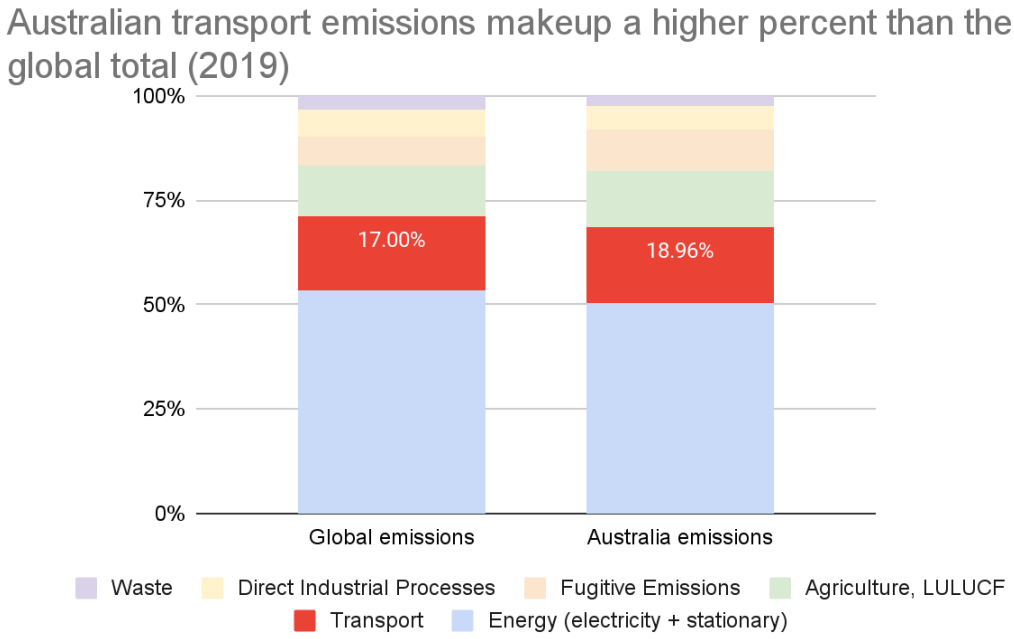
Health (and health cost) benefits too

EVs have far fewer negative health impacts compared to ICE vehicles which contribute to 11,105 premature deaths in adults, 12,210 cardiovascular hospitalisations, 6,840 respiratory hospitalisations and 66,000 active asthma cases annually[46]. While these figures are for all vehicles, CVs make a greater contribution than passenger vehicles due to their large size and greater production of particulate matter. In addition, older trucks emit at least 60 times more fine particulate matter than newer trucks[63] and an even greater amount compared to passenger vehicles.

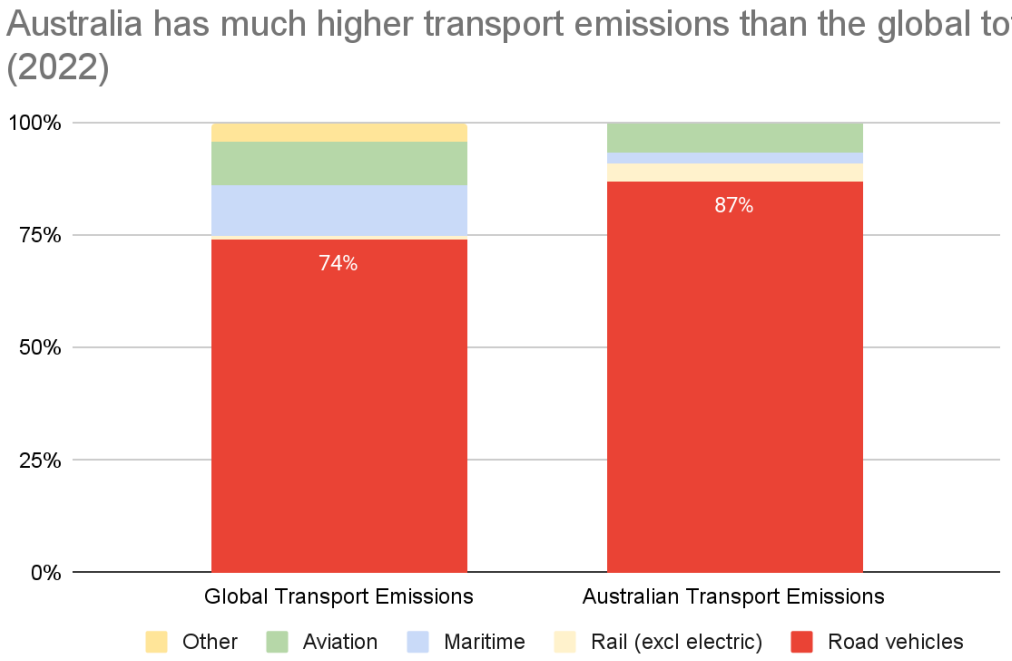
These impacts were quantified in terms of the annual cost to the New Zealand economy at $15.5 billion per annum[46]health; adjusting this to reflect Australia, ICE vehicles create up to $77.5 billion in health-related costs which can be dramatically reduced by increasing the deployment of EVs.

Appendix 2: Transport emissions explained

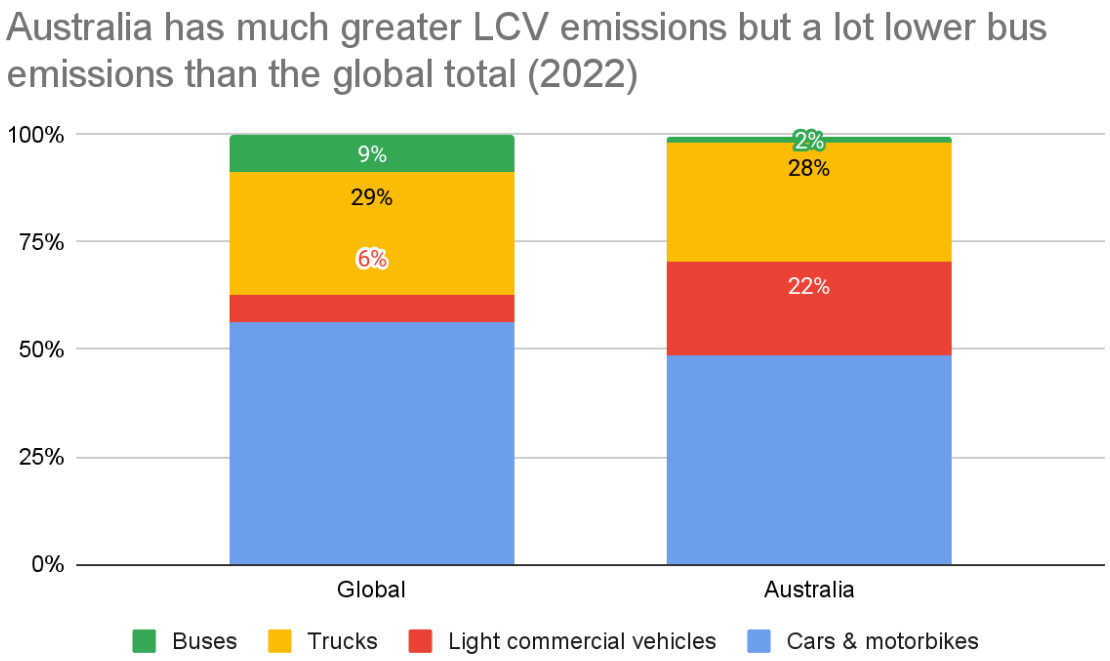
Globally, the transport sector was responsible for 17% of 2019 annual emissions[64]. In Australia the transport sector was responsible for 19% of annual emissions[3] and by 2022 this had increased to 20%[3].



The majority of transport emissions come from road transport. This is especially true in Australia where in 2022 it accounted for 86% of road transport emissions, equivalent to 18% of our total annual emissions.



CVs (buses, trucks, LCVs) account for 44% of road transport emissions globally, and 51%[4] in Australia, meaning that CVs account for ~6% of total global emissions and 9% of Australia's total emissions.



Appendix 3: CEV materials, emissions and recyclability

Materials used in CEVs	Contribution to Annual Global Emission (all uses)	Potential recyclability
Cast Iron and steel	8%[65]	100%[66]
Aluminium	3%[67]	100%[68]
Glass	0.28%[69]	100%[70]
Rubber	0.173%[71]	100%[72]
Battery Minerals	0.40%[73]	90-98%[74]
Plastics	3.40%[75]	75% in theory / 9% in practice[76]
Rare earths	0.07%[77]	7%[78]
	15% (Total)	

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For more information about moving to a zero-emissions economy, please contact:

Heidi Lee,
Chief Executive Officer
Beyond Zero Emissions

Beth Mitchell,
Head of Engagement
Beyond Zero Emissions

[redacted]

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