AGENDA
INFRASTRUCTURE, PLANNING AND ENVIRONMENT COMMITTEE
12 MAY 2022

MEMBERSHIP: Councillors J Black, L Burns, S Chowdhury, M Dickerson, V Etheridge, J Gough, R Ivey, D Mahon, P Wells and M Wright.

The meeting is scheduled to commence at 5.30 pm.

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IPEC22/18 LEAVE OF ABSENCE (ID22/886)

IPEC22/19 CONFLICTS OF INTEREST (ID22/889)

In accordance with their Oath/Affirmation under the Act, and Council's Code of Conduct, Councillors must disclose the nature of any pecuniary or non-pecuniary interest which may arise during the meeting, and manage such interests accordingly.

IPEC22/20 PROPOSED APSLEY BATTERY ENERGY STORAGE SYSTEM (ID22/892)

The Committee will be addressed by Mr D Walker of Premise regarding this item

IPEC22/21 BUILDING SUMMARY - APRIL 2022 (ID22/723) 2

The Committee had before it the report dated 30 April 2022 from the Director Development and Environment regarding Building Summary - April 2022.

IPEC22/22 DRAFT ZERO EMISSIONS FLEET STRATEGY AND IMPLEMENTATION PLAN (ID22/734) 17

The Committee had before it the report dated 26 April 2022 from the Organisational Sustainability Coordinator regarding Draft Zero Emissions Fleet Strategy and Implementation Plan.

REPORT: Building Summary - April 2022

DIVISION: Development and Environment
REPORT DATE: 30 April 2022
TRIM REFERENCE: ID22/723

EXECUTIVE SUMMARY

Purpose	Provide review and update	
Issue	• Statistical overview of the number and type of development approvals for the Dubbo Regional Local Government Area (LGA)	
Reasoning	• Provide data relating to approved Development Applications. • Provide specific statistics of the number of dwellings and other residential development approved. • Provide comparative data for corresponding period.	
Financial Implications	Budget Area	There are no financial implications arising from this report.
Policy Implications	Policy Title	There are no policy implications arising from this report.

STRATEGIC DIRECTION

The 2040 Community Strategic Plan is a vision for the development of the region out to the year 2040. The Plan includes five principle themes and a number of strategies and outcomes. This report is aligned to:

Theme:	1 Housing
CSP Objective:	1.1 Residential housing opportunity meets the current and projected needs of our community
Delivery Program Strategy:	1.1.1 A variety of residential housing types is located close to appropriate services and facilities
Theme:	3 Economy
CSP Objective:	3.7 A strategic framework is in place to maximise the realisation of economic development opportunities for the region
Delivery Program Strategy:	3.7.3 Planning controls ensure adequate and suitable land is available for new development opportunities

RECOMMENDATION

That the report of the Director Development and Environment, dated 30 April 2022, be noted.

Stephen Wallace
Director Development and Environment

SW
Director Development and Environment

REPORT

Consultation
DRC's Statutory Planning and Building and Development Certification staff assess Development Applications in accordance with Section 4.15 of the *Environmental Planning and Assessment Act 1979* and consult in accordance with Council's adopted Community Participation Plan.

Resourcing Implications
Council employ staff to receipt, lodge, assess, determine and monitor compliance of the determinations referred to in this report.

Building Summary
Provided, for information, are the latest statistics (as at the time of production of this report) for development and complying development approvals for Dubbo Regional Council.

1. Residential Building Summary

Dwellings and other residential developments approved during April 2022 were as follows:

April	
Single dwellings	14
Other residential development	0
(No. of units)	0

For consistency with land use definitions included in the Local Environmental Plan (LEP), residential development has been separated into 'Single Dwellings' (defined in the LEP as 'dwelling house') and 'Other residential development' (comprising 'dual occupancies', 'secondary dwellings', 'multi dwelling housing', 'seniors housing', 'shop top housing' and 'residential flat buildings').

These figures include development applications approved by private certifying authorities (in the form of Complying Development Certificates).

A summary of residential approvals for the former Dubbo City Council area since 2011-2012 is included in **Appendix 1.** However, it should be noted that the figures from July 2017 onwards include the approvals within the former Wellington Local Government Area as a consequence of the commencement of the merged application system.

2. Approved Development Applications

The total number of approved Development Applications (including Complying Development Certificates) for April 2022, a comparison with figures 12 months prior and the total for the respective financial years to date, are as follows:

Date	1 April 2022 – 30 April 2022	1 April 2021 – 30 April 2021
No of applications	40	95
Value	$11,998,490	$22,713,698
Date	1 July 2021 – 30 April 2022	1 July 2020 – 30 April 2021
No of applications	632	810
Value	$239,016,490	$174,238,163

A summary breakdown of the figures is included in **Appendices 2-5**.

3. Online Application Tracking

All development applications, construction certificates and complying development certificates are tracked online and can be accessed at any time. A link is available on Councillor iPads for assistance (https://planning.dubbo.nsw.gov.au/Home/Disclaimer).

What information is available?

- All development applications, construction certificates and complying development certificates submitted from 1 November 2015 will provide access to submitted plans and supporting documents as well as tracking details of the progress of the application.
- More limited information is provided for applications submitted from 1 January 2001 to 31 October 2015.
- Occupation certificates (where issued) are provided from 2010.

What information is not available?

- Application forms.
- Documentation associated with privately certified applications.
- Internal assessment reports.

Councillors are welcome to contact me should they require further information in respect of outstanding Development Applications emanating from the online tracking system.

The information included in this report is provided for notation.

APPENDICES:

1 Building Summary - April 2022

2 Approved Applications - 1 April 2022 to 30 April 2022

3 Approved Applications - 1 April 2021 to 30 April 2021

4 Approved Applications - 1 July 2021 to 30 April 2022

5 Approved Applications - 1 July 2020 to 30 April 2021

STATISTICAL INFORMATION ON *SINGLE DWELLINGS AND **OTHER RESIDENTIAL DEVELOPMENTS

		JUL	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
	2011/2012													
DCC	Single Dwellings	6	12	10	6	7	16	4	16	12	8	12	9	118
	Other Residential Developments	1	1	-	1	2	2	-	-	-	-	-	1	8
	(No of units)	(14)	(2)	(-)	(1)	(4)	(3)	(-)	(-)	(-)	(-)	(-)	(16)	(40)
	2012/2013													
DCC	Single Dwellings	3	7	14	13	9	3	9	9	13	13	15	13	121
	Other Residential Developments	4	6	-	-	1	9	-	-	1	-	2	-	23
	(No of units)	(8)	(6)	(-)	(-)	(2)	(11)	(-)	(-)	(2)	(-)	(39)	(-)	(68)
	2013/2014***													
DCC	Single Dwellings	23	17	25	20	14	15	19	10	18	14	19	14	208
	Other Residential Developments	-	1	1	-	-	1	4	2	1	2	-	3	15
	(No of units)	(-)	(2)	(2)	(-)	(-)	(2)	(46)	(1)	(2)	(4)	(-)	(6)	(65)
	2014/2015***													
DCC	Single Dwellings	19	34	19	21	13	16	14	12	20	19	15	20	222
	Other Residential Developments	3	1	6	5	6	12	-	4	2	1	9	5	54
	(No of units)	(6)	(2)	(31)	(50)	(6)	(21)	(-)	(87)	(4)	(1)	(25)	(10)	(243)
	2015/2016***													
DCC	Single Dwellings	27	20	26	19	21	26	19	14	16	17	17	22	244
	Other Residential Developments	6	8	8	4	1	3	3	3	3	5	3	8	55
	(No of units)	(50)	(98)	(12)	(7)	(2)	(5)	(18)	(4)	(5)	(14)	(6)	(23)	(244)
	2016/2017***													
	Single Dwellings	24	13	17	18	12	21	16	18	18	14	18	36	225
DCC	Other Residential Developments	8	5	7	4	6	5	3	2	1	5	4	7	57
	(No of units)	(10)	(10)	(13)	(7)	(10)	(16)	(6)	(75)	(2)	(8)	(13)	(14)	(184)
	2017/2018***													
	Single Dwellings	26	21	13	12	16	19	4	22	16	21	22	16	208
DRC	Other Residential Developments	6	9	2	1	9	1	5	5	11	1	3	5	58
	(No of units)	(11)	(16)	(3)	(2)	(16)	(2)	(8)	(5)	(23)	(2)	(3)	(9)	(100)
	2018/2019***													
	Single Dwellings	15	26	13	7	17	8	19	5	8	11	19	6	154
DRC	Other Residential Developments	3	4	3	-	6	2	2	1	5	7	9	5	47
	(No of units)	(4)	(7)	(5)	(-)	(11)	(29)	(4)	(1)	(12)	(25)	(15)	(10)	(123)

		JUL	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
	2019/2020***													
DRC	Single Dwellings	16	11	8	18	27	14	4	5	10	8	8	8	137
	Other Residential Developments	4	4	3	4	11	6	1	4	2	1	1	1	42
	(No of units)	(8)	(7)	(6)	(7)	(19)	(10)	(2)	(7)	(2)	(2)	(2)	(1)	(73)

		JUL	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
	2020/2021***													
DRC	Single Dwellings	7	17	21	12	20	46	18	25	30	27	17	20	260
	Other Residential Developments	5	2	5	6	3	15	2	6	5	5	7	9	70
	(No of units)	(7)	(4)	(11)	(10)	(4)	(35)	(5)	(10)	(8)	(9)	(47)	(14)	(164)

		JUL	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
	2021/2022***													
DRC	Single Dwellings	28	15	15	13	16	39	5	17	22	14			184
	Other Residential Developments	8	6	2	4	5	7	7	8	4	-			51
	(No of units)	(12)	(28)	(3)	(6)	(13)	(11)	(9)	(15)	(6)	(-)			(103)

* Single Dwellings = Single "Dwelling House'

** Other Residential Developments = Dual occupancies, secondary dwellings, multi dwelling housing, seniors housing, shop top housing and residential flat buildings

*** Includes private certifiers

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Print Date: 2/05/2022
Print Time: 8:25:35AM

Approved Development & Complying Development Applications by Dubbo Regional Council and Private Certifiers-Period 1/04/2022 - 30/04/2022

Development Type	Number of Applications	Est. $	New Developments	Est. $	Additions and Alterations	Est. $	New Dwellings	New Lots
Alterations and additions to commercial	2	1,150,000			2	1,150,000		
Alterations and additions to residential	4	1,164,712			4	1,164,712		
Balconies, decks patios terraces or ve	1	52,000	1	52,000				
Dwelling	14	6,220,330	14	6,220,330			14	
Educational establishment	1	2,000,000			1	2,000,000		
Garages carports and car parking spaces	5	74,953	5	74,953				
Industrial development	1	306,300	1	306,300				
Other	1	350,000	1	350,000				
Pools / decks / fencing	7	313,669	7	313,669				
Shed	6	316,526	6	316,526				
Change of Use	1	50,000	1	50,000				
Totals for Development Types	43	11,998,490						

Total Number of Applications for this period: 40

*** Note: There may be more than one Development Type per Development Application
Statistics include applications by Private Certifiers

-------- End of Report --------

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Approved Development & Complying Development Applications by Dubbo Regional Council and Private Certifiers-Period 1/04/2021 - 30/04/2021

Development Type	Number of Applications	Est. $	New Developments	Est. $	Additions and Alterations	Est. $	New Dwellings	New Lots
Dwelling - single	44	12,968,962	34	12,020,182	10	948,780	34	
Dwelling - Secondary/Dual Occ Dwelling	2	421,000	2	421,000			3	
Dwelling - Dual Occupancy, one storey	4	2,003,500	4	2,003,500			8	4
Garage/Carport/Roofed Outbuildings	22	353,568	21	314,392	1	39,176		
Fences/Unroofed Structures	1	2,000	1	2,000				
Swimming Pool	9	291,110	9	291,110				
Office Building	1	600,000	1	600,000				
Retail Building	5	2,707,883	1	2,110,402	4	597,481		
Warehouse/storage	1	56,100	1	56,100				
Carpark	1	308,000	1	308,000				
Infrastructure - Transport, Utilities	1	150,000	1	150,000				
Signs/Advertising Structure	2	33,000	2	33,000				
Home Industry	1	0			1			
Agricultural Development	1	876,000	1	876,000				
Subdivision - Residential	5	1,894,575						61
Subdivision - Commercial	1	48,000						2
Subdivision - Rural	1	0						2
Totals for Development Types	102	22,713,698						

Total Number of Applications for this period: 95

*** Note: There may be more than one Development Type per Development Application
Statistics include applications by Private Certifiers

Approved Development & Complying Development Applications
by Dubbo Regional Council and Private Certifiers-Period 1/04/2021 - 30/04/2021

Development Type	Number of Applications	Est. $	New Developments	Est. $	Additions and Alterations	Est. $	New Dwellings	New Lots

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Approved Development & Complying Development Applications by Dubbo Regional Council and Private Certifiers-Period 1/07/2021 - 30/04/2022

Development Type	Number of Applications	Est. $	New Developments	Est. $	Additions and Alterations	Est. $	New Dwellings	New Lots
Dwelling - single	**20**	**5,224,595**	**13**	4,177,193	**7**	1,047,402	13	
Dwelling- Transportable/Relocatable	**2**	**615,398**	**2**	615,398			2	
Dwelling - Secondary/Dual Occ Dwelling	**4**	**725,127**	**4**	725,127			4	
Dwelling - Dual Occupancy, one storey	**6**	**2,706,000**	**6**	2,706,000			12	
Medium Density Res - one/two storeys	**2**	**12,502,410**	**2**	12,502,410			57	
Garage/Carport/Roofed Outbuildings	**12**	**248,792**	**12**	248,792				
Fences/Unroofed Structures	**1**	**13,000**	**1**	13,000				
Swimming Pool	**4**	**127,500**	**4**	127,500				
Office Building	**3**	**511,000**	**2**	498,000	**1**	13,000		
Retail Building	**1**	**348,700**			**1**	348,700		
Retail & Residential Building	**1**	**28,000,000**	**1**	28,000,000				
Factory/Production Building	**1**	**1,000,000**	**1**	1,000,000				
Warehouse/storage	**4**	**1,378,800**	**4**	1,378,800				
Health Care Facility - Other	**2**	**710,000**	**1**	710,000	**1**			
Educational Building	**2**	**32,573,529**	**2**	32,573,529				
Entertainment/Recreational Building	**1**	**60,000**			**1**	60,000		
Signs/Advertising Structure	**1**	**12,000**	**1**	12,000				
Home Business	**1**	**2,000**			**1**	2,000		
Change of Use - Commercial	**3**	**23,000**			**2**	3,000		13
Tourism Development	**2**	**3,830,000**	**1**	3,600,000	**1**	230,000		
Subdivision - Residential	**11**	**2,577,000**						37
Subdivision - Industrial	**1**	**60,000**						3

Approved Development & Complying Development Applications
by Dubbo Regional Council and Private Certifiers-Period 1/07/2021 - 30/04/2022

Development Type	Number of Applications	Est. $	New Developments	Est. $	Additions and Alterations	Est. $	New Dwellings	New Lots
Subdivision - Rural	**3**	**21,500**	**1**	5,000				2
Alterations and additions to commercial	**18**	**6,801,023**			**18**	6,801,023		
Alterations and additions to industrial	**2**	**2,529,558**			**2**	2,529,558		
Alterations and additions to residential	**39**	**5,946,986**			**39**	5,946,986		
Attached dwelling	**1**	**75,000**			**1**	75,000		
Balconies, decks patios terraces or ve	**23**	**438,089**	**23**	438,089				
Boarding house	**2**	**1,616,015**	**2**	1,616,015			3	2
Demolition	**15**	**366,000**	**15**	366,000				
Dual occupancy	**20**	**10,385,091**	**20**	10,385,091			37	8
Dwelling	**182**	**68,815,533**	**182**	68,815,533			182	
Earthworks / change in levels	**2**	**84,320**	**2**	84,320				
Educational establishment	**3**	**2,030,000**	**1**	30,000	**2**	2,000,000		
Farm buildings	**1**	**45,000**	**1**	45,000				
Garages carports and car parking spaces	**29**	**636,984**	**29**	636,984			1	
Group homes	**2**	**2,400,000**	**2**	2,400,000			2	
Health services facilities	**1**	**340,000**	**1**	340,000				
Home business	**2**	**5,500**	**2**	5,500				
Industrial development	**16**	**14,235,630**	**15**	14,135,630	**1**	100,000		
Multi-dwelling housing	**2**	**2,080,000**	**2**	2,080,000			11	
Other	**11**	**9,189,398**	**11**	9,189,398				
Pools / decks / fencing	**92**	**3,544,624**	**92**	3,544,624			1	
Pub	**1**	**46,750**	**1**	46,750				
Recreational uses	**2**	**4,611,000**	**2**	4,611,000				
Restaurant or cafe	**1**	**109,000**			**1**	109,000		
Retaining walls, protection of trees"	**1**	**0**	**1**					
Secondary dwelling	**20**	**2,686,065**	**20**	2,686,065			20	
Shed	**70**	**2,086,597**	**70**	2,086,597			1	
Signage	**14**	**665,705**	**14**	665,705				

Approved Development & Complying Development Applications
by Dubbo Regional Council and Private Certifiers-Period 1/07/2021 - 30/04/2022

Development Type	Number of Applications	Est. $	New Developments	Est. $	Additions and Alterations	Est. $	New Dwellings	New Lots
Subdivision of land	**26**	**2,147,000**	**18**	1,975,000				234
Take-away food and drink premises	**3**	**429,700**			**3**	429,700		
Telecommunications and communication fac	**1**	**300,000**	**1**	300,000				
Business Premises	**1**	**250,000**	**1**	250,000				
Retail Premises	**6**	**429,500**	**4**	205,500	**2**	224,000		
Change of Use	**9**	**353,000**	**7**	98,000	**2**	255,000		
Artisanal Food and Drink	**1**	**22,500**	**1**	22,500				
Carport or garage	**3**	**42,571**	**3**	42,571				
Demolition	**1**	**2,000**	**1**	2,000				
Totals for Development Types	**711**	**239,016,490**						

Total Number of Applications for this period: 632

*** Note: There may be more than one Development Type per Development Application
Statistics include applications by Private Certifiers

-------- End of Report --------

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Approved Development & Complying Development Applications by Dubbo Regional Council and Private Certifiers-Period 1/07/2020 - 30/04/2021

Development Type	Number of Applications	Est. $	New Developments	Est. $	Additions and Alterations	Est. $	New Dwellings	New Lots
Dwelling - single	**331**	**100,138,170**	**261**	89,731,690	**70**	10,406,480	261	1
Dwelling- Transportable/Relocatable	**4**	**814,800**	**4**	814,800			4	
Dwelling - Secondary/Dual Occ Dwelling	**39**	**12,175,795**	**39**	12,175,795			63	
Dwelling - Dual Occupancy, one storey	**17**	**7,424,700**	**17**	7,424,700			32	4
Dwelling - Dual Occupancy, >one storey	**1**	**570,000**	**1**	570,000			3	
Medium Density Res - one/two storeys	**2**	**2,000,000**	**2**	2,000,000			7	
Medium Density Res - Seniors Living SEPP	**1**	**2,400,000**	**1**	2,400,000			10	
Garage/Carport/Roofed Outbuildings	**214**	**5,335,889**	**206**	5,165,682	**8**	170,207		
Fences/Unroofed Structures	**6**	**62,750**	**5**	43,500	**1**	19,250		
Swimming Pool	**92**	**2,568,967**	**92**	2,568,967				
Office Building	**10**	**2,491,773**	**2**	875,000	**8**	1,616,773		
Retail Building	**18**	**7,993,439**	**2**	6,110,402	**16**	1,883,037		
Hotels	**1**	**460,000**			**1**	460,000		
Office & Retail Building	**5**	**1,649,500**	**2**	1,360,000	**3**	289,500		
Factory/Production Building	**7**	**3,777,247**	**3**	1,325,000	**4**	2,452,247		
Warehouse/storage	**9**	**3,883,100**	**8**	3,826,100	**1**	57,000		
Carpark	**1**	**308,000**	**1**	308,000				
Infrastructure - Transport, Utilities	**4**	**3,430,000**	**4**	3,430,000				
Educational Building	**2**	**1,924,500**	**1**	1,900,000	**1**	24,500		
Place of Worship	**1**	**1,000,000**			**1**	1,000,000		
Community/Public Building	**1**	**80,000**			**1**	80,000		
Signs/Advertising Structure	**13**	**403,015**	**10**	342,815	**3**	60,200		

Approved Development & Complying Development Applications
by Dubbo Regional Council and Private Certifiers-Period 1/07/2020 - 30/04/2021

Development Type	Number of Applications	Est. $	New Developments	Est. $	Additions and Alterations	Est. $	New Dwellings	New Lots
Demolition	**6**	**58,000**	**1**	2,000	**5**	56,000		
Home Business	**1**	**1,000**			**1**	1,000		
Home Industry	**1**	**0**			**1**			
Change of Use - Commercial	**9**	**330,000**	**3**	70,000	**6**	260,000		
Change of Use - Industrial	**2**	**0**			**2**			
Agricultural Development	**3**	**1,176,000**	**3**	1,176,000				
Parks/Reserves	**1**	**72,000**	**1**	72,000				
Subdivision - Residential	**33**	**5,105,575**	**1**					2
Subdivision - Commercial	**2**	**75,000**						4
Subdivision - Industrial	**4**	**828,000**						10
Subdivision - Rural	**6**	**45,000**						12
Miscellaneous	**8**	**4,310,000**	**6**	4,266,000	**2**	44,000		
Alterations and additions to commercial	**2**	**189,293**			**2**	189,293		
Dwelling	**4**	**1,051,650**	**4**	1,051,650			4	
Secondary dwelling	**1**	**105,000**	**1**	105,000			1	
Totals for Development Types	**862**	**174,238,163**						

Total Number of Applications for this period: 810

*** Note: There may be more than one Development Type per Development Application
Statistics include applications by Private Certifiers

-------- End of Report --------

REPORT: Draft Zero Emissions Fleet Strategy and Implementation Plan

DIVISION: Development and Environment
REPORT DATE: 26 April 2022
TRIM REFERENCE: ID22/734

EXECUTIVE SUMMARY

Purpose	Seek endorsement
Issue	Transport is Australia's third largest source of greenhouse gas emissions, accounting for 17% of total emissions. Council's fuel use (petrol, diesel) currently results in 12% of Council's greenhouse gas emissions from energy consumption (electricity, gas, fuel). The Dubbo Regional Council Zero Emission Fleet (ZEF) Strategy and Implementation Plan is designed to support and guide Council in reducing greenhouse gas emissions associated with its fleet operations.
Reasoning	In December 2020 Council engaged Evenergi to aid Council in better understanding the business case and roadmap for transitioning to a zero emissions fleet. The final Roadmap has assisted Council in the development of this ZEF Strategy and Implementation Plan and forms Part 1 of the document. The Roadmap concluded that there is a very strong business case for transitioning to a zero emissions fleet. Transitioning to a zero emissions fleet will assist Council to: • *Reduce fleet operating costs over a 10 year period (2021-2030)* The quantitative fleet analysis estimated a potential reduction of costs from executing a Zero Emissions Fleet Roadmap of up to $2.47 million or 5.5% compared to "business as usual" over the 10 year period to 2030 if the transition is managed appropriately. • *Mitigate greenhouse gas emissions associated with Council's fleet operations* Council's fuel use (petrol, diesel) currently results in 12% of Council's greenhouse gas emissions from energy consumption (electricity, gas, fuel). By executing a Zero Emissions Fleet Roadmap analysis estimated a potential emissions reduction of at least 1,760 tonnes CO2 equivalent, or 9% of the combined light and heavy vehicle fleet emissions over the 10 year period to 2030.

	The Roadmap outlines a number of pathways to transition for the light and heavy vehicle fleet. Light vehicles will transition more quickly than heavy vehicles as few 'fit for purpose' zero emissions heavy vehicles are currently available on the market. The speed at which Council's fleet will transition will increase as electric vehicle technology advances, vehicle availability improves, and costs reduce. The changing nature of global vehicle supply, driven by government mandates in many countries, is likely to introduce risks to 'business as usual' with increasing vehicle prices and lower choice for traditionally powered fleet options.	
Financial Implications	Budget Area	Key strategic goals, outcomes and actions will need to be incorporated by relevant Directors and Managers into Council's four year Delivery and one year Operational Plans once approved and budgeted appropriately.
Policy Implications	Policy Title	Management Policy – Fleet Services Staff Leaseback Agreement 2022
	Impact on Policy	Council's Management Policy – Fleet Services and Staff Leaseback Agreement 2022 will need to be reviewed in order to align with the Strategy and Implementation Plan's key strategic goals, targets, outcomes and actions.

STRATEGIC DIRECTION

The 2040 Community Strategic Plan is a vision for the development of the region out to the year 2040. The Plan includes five principle themes and a number of strategies and outcomes. This report is aligned to:

Theme:	4 Community Leadership
CSP Objective:	4.3 The resources of Council are appropriately managed
Delivery Program Strategy:	4.3.4 Council's ability and capacity to deliver services and respond to emergencies is enabled by the utilisation of a modern and efficient plant fleet that meets operational needs
Theme:	5 Liveability
CSP Objective:	5.9 Environmental sustainability is a priority
Delivery Program Strategy:	5.9.1 The community is supported in becoming sustainable

Theme:	2 Infrastructure
CSP Objective:	2.1 Opportunities for use of renewable energy are increased
Delivery Program Strategy:	2.1.3 Council buildings and facilities are energy efficient and welcome opportunities for renewable energy supply

RECOMMENDATION

1. **That the draft Dubbo Regional Council Zero Emissions Fleet Strategy and Implementation Plan be endorsed by Council for the purposes of public consultation.**
2. **That the draft Dubbo Regional Council Zero Emissions Fleet Strategy and Implementation Plan be placed on public display for a period of 28 days.**
3. **Following completion of public display a further report, including the results of the public consultation, be provided to Council for consideration.**

Darryll Quigley
Manager Building and Development Services

CJ
Organisational Sustainability Coordinator

BACKGROUND

Transport is Australia's third largest source of greenhouse gas emissions, accounting for 17% of total emissions. Council's fuel use (petrol, diesel) currently results in 12% of Council's greenhouse gas emissions from energy consumption (electricity, gas, fuel). More specifically, diesel fuel use accounts for 11% of Council's greenhouse gas emissions relating to energy consumption and petrol fuel use around 1%.

Council's requirement for the development of the Zero Emissions Fleet Strategy and Implementation Plan has arisen from Council's adopted Energy Strategy and Implementation Plan 2020 to 2025, which includes a Sustainable Transport goal to "… plan for and begin to transition to a zero emissions fleet."

Council's requirements for the development of the Energy Strategy and Implementation Plan originated from the 2040 Community Strategic Plan (CSP) which states under Strategy 2.1.3.3 that an energy strategy is to be prepared for Council facilities and buildings by the Division of Development and Environment.

Additional CSP strategies supporting the development of the ZEF Strategy and Implementation Plan include: 4.3.4 Council's ability and capacity to deliver services and respond to emergencies is enabled by the utilisation of a modern and efficient plant fleet that meets operational needs; and 5.9 Environmental sustainability is a priority.

A zero emissions fleet includes vehicles that do not emit any greenhouse gas emissions, such as battery electric (BEV) and hydrogen fuel cell electric vehicles (FCEVs). The transition to a zero emissions fleet can include hybrid electric (HEV) and plug-in hybrid electric (PHEV) vehicles, which utilise both fuel and electricity, but are not zero emissions.

The benefits of transitioning to a zero emissions fleet include reduced greenhouse gas emissions, improved air quality, less noise, and lower running costs than conventional vehicles as a result of decreased fuel and servicing costs.

While zero emissions vehicle (ZEV) charging will increase electricity demand, emissions from vehicle charging will fall as Council increases the proportion of its electricity from renewable sources. In addition, any hydrogen procured for fuel would need to be produced from renewable energy sources to remain a zero emissions option.

REPORT

Consultation

- Council's Organisational Sustainability Coordinator has worked in partnership with Fleet and Depot Services and Building Services to develop the draft Strategy and Implementation Plan. Consultation has been through numerous meetings and provision of draft Strategy and Plan to each branch Manager.

- Council's Organisational Sustainability Coordinator has also requested feedback on the draft Strategy and Plan from consultant Evenergi who developed the initial Council Roadmap forming Part 1 of the Strategy.
- In addition, the draft ZEF Strategy and Implementation Plan has been endorsed in principle by the Executive Leadership Team (ELT) at its meeting on 20 April 2022 with additional ELT feedback incorporated into the revised draft attached to this Report.

Resourcing Implications

Key strategic goals, outcomes and actions will need to be incorporated by relevant Directors and Managers into Council's four year Delivery and one year Operational Plans once approved, and budgeted appropriately.

The proposed Strategy will support the direction and outcomes Council would like to achieve, and the Implementation Plan will provide the actions and tasks for achieving the key strategic objectives under the key strategy areas.

1. Strategic Framework

The Dubbo Regional Council Zero Emission Fleet (ZEF) Strategy and Implementation Plan is designed to support and guide Council in reducing greenhouse gas emissions associated with its fleet operations.

The Strategy and Implementation Plan will sit below Council's 2040 Community Strategic Plan and inform Council's four year Delivery and one year Operational Plans.

The ZEF Strategy and Implementation Plan has been developed in four parts as outlined below:

(a) Part 1: Council Roadmap (Evenergi)

This Roadmap provides the overall context for the ZEF Strategy and Implementation Plan and has been developed for Council by Evenergi, a consultant specialising in assisting organisations to plan, implement and transition to zero emission fleet operations. It also assesses the feasibility of the transition for Council including understanding what vehicles can transition and when, and what costs and resources would be required.

In particular, the Roadmap examined and provided commentary around:
- The importance of transitioning to a zero emissions fleet;
- International, national and state legislative policy;
- Predicted trends for Australia in 2025, 2030 and to 2050;
- Barriers or challenges in transitioning to a zero emissions fleet;
- Council's existing fleet operations;
- Fleet transition analysis of both light and heavy vehicles;
- Vehicle procurement and management;
- Infrastructure procurement and management;

- Key Enablers, including governance, policies, procedures and financing;
- Key Recommendations, including suggested action pathways.

Key findings of the Roadmap highlighted in the ZEF Strategy and Implementation Plan include:

- The business case for Council to transition is strong;
- Council's pathway to transition will continue to evolve;
- Change is inevitable; and
- There are incentives for early adopters.

(b) Part 2: Strategy

This section uses the information collected in Part 1 to outline Council's strategic vision, goals, targets, and outcomes for the management of Council's fleet. The vision for the Strategy is proposed as follows: *Dubbo Regional Council plans for, and begins to transition to, a zero emissions fleet.*

Four key strategy areas make up the Strategy:

1. Light Vehicles - addressing light vehicle selection, procurement and use;
2. Heavy Vehicles - addressing heavy vehicle selection, procurement and use;
3. Servicing and Maintenance – addressing vehicle servicing and maintenance of Council's zero emission light and heavy vehicle fleet; and
4. Charging Infrastructure - addressing charging infrastructure and software selection, procurement, installation, use, servicing and maintenance.

Each key strategy area includes a goal, target and desired strategic outcomes.

(c) Part 3: Implementation Plan

This section contains specific actions for implementation to ensure the strategic outcomes in the Zero Emissions Fleet Strategy are achieved.

The delivery timeframe for the Plan will be from when the Zero Emissions Fleet Strategy and Implementation Plan is adopted by the Executive Leadership Team and/or Council until June 2025.

The delivery timeframe is split into three categories and assigned against each specific action:

- Short Term – completion within 1-2 years
- Medium Term – completion within 3-4 years
- Ongoing – a recurring event to be completed on a continuing basis

(d) Part 4: Monitoring, Reporting and Review

This section describes how the ZEF Strategy and Implementation Plan will be monitored, reported and reviewed.

Key strategic goals, outcomes and actions from the Strategy and Implementation Plan must be incorporated by relevant Directors and Managers into Council's four year Delivery and one year Operational Plans.

In this light any progress achieved against the Strategy and Implementation Plan will be reported on by the Responsible Council Officer through the standard Council Integrated Planning and Reporting process:

- Progress Reports - Every Six Months; and
- Annual Report - Annually (November).

A detailed strategic review of the ZEF Strategy and Implementation Plan will then be completed by December 2024.

2. Strategy Goals and Targets

Each of the four key strategy areas includes a specific goal and target, and the supporting rationale for each is highlighted below.

a) Light Vehicles

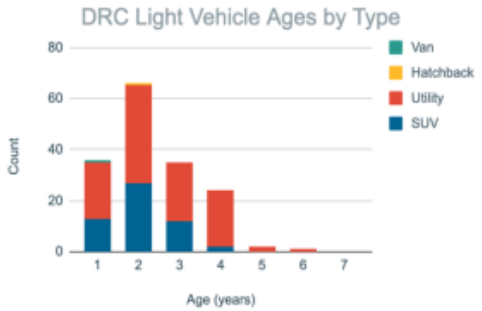
Council's light vehicle fleet currently contains 171 vehicles, with light commercial vehicles (e.g. utilities and vans) making up around two thirds of the light vehicle fleet. SUVs make up 27% of the fleet, with less than 7% of the light vehicle fleet being conventional passenger vehicles.

Council's light vehicle fleet accounts for 20.9% of Council's fleet greenhouse gas emissions, with light commercial vehicles contributing to a vast majority of those emissions.

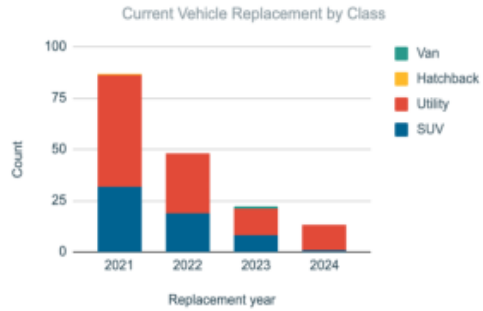
A relatively large proportion of light fleet assets are set for replacement in the coming financial years and provide opportunities for transition.

Figure 6: Age distribution of vehicles in the DRC light fleet

Age Distribution by Type



Expected Replacement Date (next cycle)



Source: DRC Zero Emissions Fleet Roadmap, Evenergi November 2021

Zero emission vehicles cost more upfront, but become much more cost effective when assessed on the full lifetime costs or Total Cost of Ownership (TCO), rather than solely on the upfront cost. The Roadmap considers TCO 'price parity' as a significant milestone or signal for transitioning to a zero emissions vehicle. This is when it is cheaper to own a zero emissions vehicle, compared to a traditionally powered vehicle, when costs are compared across the lifetime of the vehicle.

In examining the future transition of Council's light vehicle fleet the Roadmap indicates that Council's transition will be staggered as the TCO parity of a 'fit for purpose' low to zero emission vehicle with a traditionally powered vehicle varies greatly between each vehicle segment.

Table 18: When to expect electric vehicles to achieve TCO parity

Asset segment	Estimated TCO parity for EVs	Asset segment	Estimated TCO parity for EVs
Large Passenger	2025/26	Medium SUV	2025/26
Medium Passenger	2024/25	Small SUV	2024/25
Small Passenger	2023/24	LCV Ute	2026/27
Light Passenger	2022/23	LCV Van	2026/27
Large SUV	2026/27	LCV Commuter (Bus)	2026/27

Source: DRC Zero Emissions Fleet Roadmap, Evenergi November 2021

In this regard, Council's passenger vehicles and SUVs will transition sooner, with light commercial vehicles (utilities and vans), which make up the majority of Council's light vehicle fleet and its emissions, not expected to transition until after 2025 where it is predicted zero emission versions of these vehicles become more readily available on the Australian market.

The availability and cost of electric vehicles will be subject to great change in the coming years with significant investment in electric vehicle research and development.

The Roadmap suggests that Council could introduce a number of measures to aid electrification of its light vehicle fleet during this time. An example includes introducing a transitional arrangement for the light vehicle asset replacement schedule such as extending the holding period of existing vehicles by an additional year to take advantage of any improvements in electric vehicle availability and prices over time. The business case for purchasing electric vehicles could also be improved by extending their holding period and through higher utilisation for short trips.

The following goals and targets are proposed for light vehicles based on the above rationale:

Goal:
Dubbo Regional Council will progressively switch to low or zero emissions vehicles within its light vehicle fleet at the time of renewal, where the total cost of ownership (TCO) is equal to or less than the TCO of the existing traditionally powered vehicle and the vehicle is fit for purpose.

Target:
Dubbo Regional Council aims to transition at least 15% of its light vehicle fleet to low (e.g. hybrid or plug-in hybrid) or zero emission vehicles (battery electric) by December 2025*.

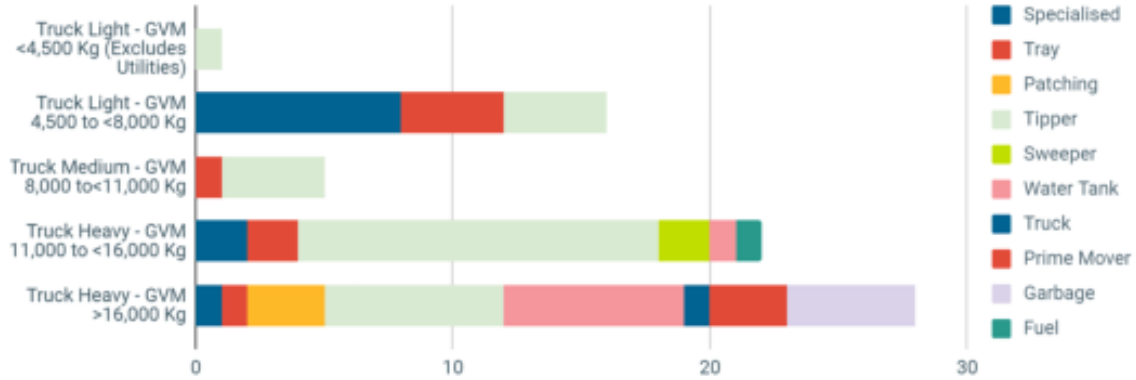
Target	**% of Council light vehicle fleet low or zero emission vehicles**	**Estimated no. and type of low or zero emission vehicles in fleet to reach target**	**Estimated no. of charging infrastructure to reach target**
2023	5%	5 Hybrid Electric (HEV) 2 Plug In Hybrid (PHEV) 3 Battery Electric (BEV)	5 'smart' Level 2 AC fast chargers (7-22 kW)
2025	15%	15 Hybrid Electric (HEV) 3 Plug In Hybrid (PHEV) 7 Battery Electric (BEV)	10 'smart' Level 2 AC fast chargers (7-22 kW)

**Consideration should be given to vehicles with charging capabilities such as vehicle to grid (V2G), vehicle to home (V2H) or vehicle to load (V2L). These technologies however are relatively new and may limit electric vehicle options.*

b) Heavy Vehicles

Council's heavy vehicle fleet currently contains 72 vehicles, with the dominant vehicle class being tipper trucks. There is a tendency within the fleet for heavier vehicles, with nearly three quarters of the fleet over 11 tonnes GVM.

Figure 4: DRC heavy fleet composition by functional type

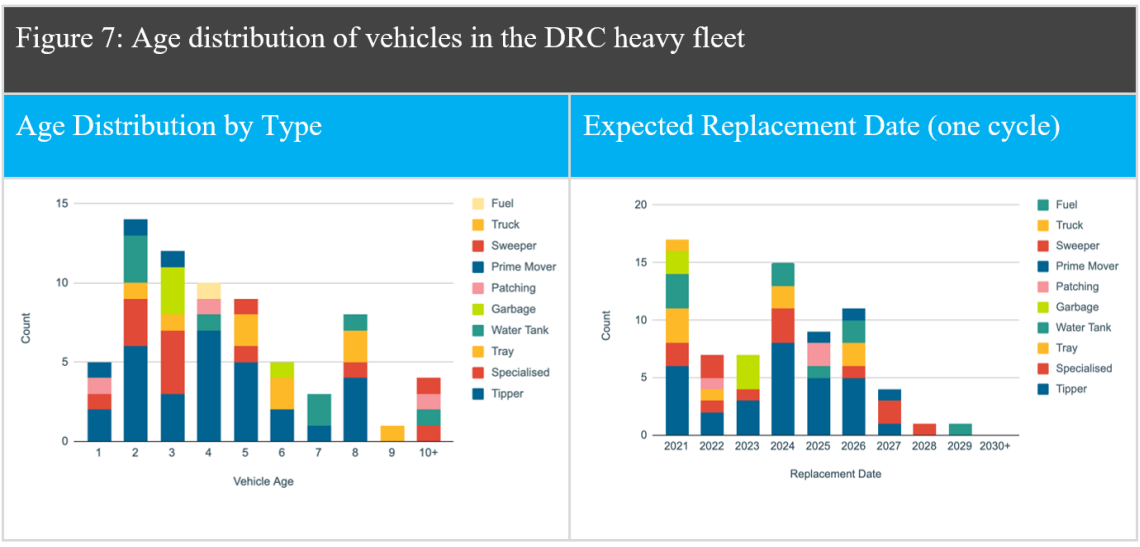


Source: DRC Zero Emissions Fleet Roadmap, Evenergi November 2021

Council's heavy truck fleet and heavy plant dominate Council emissions accounting for over 60% of total fleet greenhouse gas emissions.

A relatively large proportion of heavy fleet assets are set for replacement in the coming financial years.

Figure 7: Age distribution of vehicles in the DRC heavy fleet



Source: DRC Zero Emissions Fleet Roadmap, Evenergi November 2021

The business case for low to zero emissions heavy vehicles and availability of appropriate vehicles is generally poor, which will result in a period of relative inaction for heavy vehicle fleet transition particularly before 2025.

A like for like replacement analysis was conducted as part of the Roadmap which concluded that given current technology only seven heavy vehicles had an operationally straightforward electric option available on the market at "… the time of scheduled replacement" and with a positive total cost of ownership over a ten year period. In addition, the Roadmap concluded that hydrogen powered (Hydrogen Fuel Cell) vehicles are more than 10 years from cost-effective fleet operation in a regional setting.

The technical specification, cost and weight improvements expected in the heavy electric vehicle industry over the next ten years will increasingly improve the business case for electrification of Council's heavy vehicle fleet. Given the significant investments globally in zero emission vehicle research and development, there is also potential for a break-through in operational capabilities sooner than projected.

It is also likely that the Central West Orana Renewable Energy Zone (REZ) may provide some opportunities for Council to invest in hydrogen fuel cell technology should hydrogen infrastructure investment occur within REZ.

Council's heavy vehicle fleet transition pathway prior to 2025 will therefore focus on trialling a number of zero emission options, adopting a pilot and learn approach. A key element of this approach will be ensuring that Council collates relevant data on its heavy vehicle requirements (e.g. payload), and tracks and monitors the performance of any trial low or zero emission heavy vehicles.

The following goals and targets are proposed for heavy vehicles based on the above rationale:

Goal:
Dubbo Regional Council will progressively switch to low or zero emissions vehicles within its heavy vehicle fleet at the time of renewal, where the total cost of ownership (TCO) is equal to or less than the TCO of the existing traditionally powered vehicle and the vehicle is fit for purpose.

Target:
Dubbo Regional Council trials at least three low to zero emission vehicles within its heavy vehicle fleet by December 2025.

c) Servicing and Maintenance

Electric vehicles only have a small number of moving parts that require maintenance, such as software updates, brakes, brake fluid, wiper fluid, wiper blades, tyre and wheel alignment and care, air conditioning servicing and the cabin air filter. Major servicing issues such as motor bearing failure and battery degradation are not issues that normally arise in the operational life of electric vehicles, but would be warranty covered items.

In this regard, electric vehicles will require both in house and external servicing and maintenance. Whilst Council may be able to attend to most maintenance requirements at a significant saving over external servicing, any sensor failures and associated error codes will require the vehicle to be sent to a dealership with access to special IP owned by the vehicle manufacturer. In addition vehicle dealerships may be required for scheduled servicing to ensure warranty compliance, or to address any warranty claims.

The Roadmap indicates that in the early years of transition Council may grapple with the lack of vehicle dealership support, but some local dealers such as Nissan, Kia and Hyundai are working towards electric vehicle readiness in the region.

Council will need to ensure in house maintenance staff attain the skills required, and develop any procedures and policies to ensure a 'safe work environment' when working with electric vehicles.

The following goals and targets are proposed for electric vehicle servicing and maintenance based on the above rationale:

Goal:
Dubbo Regional Council plans for and provides vehicle servicing and maintenance aligned to Council's Zero Emission Fleet Strategy goals and targets.

Target:
Dubbo Regional Council develops a Vehicle Servicing and Maintenance Policy aligned to Council's Zero Emission Fleet Strategy goals and targets by December 2023.

d) Charging Infrastructure

The number of chargers required to be installed in the early years of transition is recommended to be "… one charger per one electric vehicle" procured until it has been operationally demonstrated that this number of chargers is not required. Council will obtain a better understanding of the required number of chargers through real world experience obtained in the early phases of transition and also the use of telematics.

The type of chargers installed must be 'smart' or controllable chargers to ensure load management systems, which integrate with all chargers on site and regulate their output, can be installed to reduce ongoing energy costs and impacts on the electricity network. Consideration should be given to chargers with vehicle to grid (V2G), vehicle to home (V2H), or vehicle to load (V2L) capabilities, however these technologies are relatively new and may limit electric vehicle options in the very near future.

The size of chargers required at these sites will be Level 2 AC fast chargers (7- 22 kW). 7.5kW or 11kW chargers were recommended for the majority of Council's fleet, a step up from the basic home charger, suiting vehicles with stable charging demands such as vehicles doing round trips, with a known location and availability for charging. Only Council's depots

(Hawthorne St, Amaroo Drive) were recommended to install a '22 kW' Level 2 AC fast charging charger from 2025 which can provide a faster charging time and suit vehicles with irregular trips and shorter dwelling times. It was not recommended that Council install Level 3 DC Rapid Chargers (e.g. Tesla, NRMA) for its fleet.

The priority location for charging infrastructure will be Council buildings and facilities which house the majority of Council's fleet, such as the Dubbo Hawthorne Street Depot, Wellington Amaroo Drive Depot and the Dubbo Civic Administration Building. However households will also play a critical role with one in three vehicles within Council's fleet considered suitable for home charging (97 of 291 vehicles). Many factors however will need to be considered before Council installs home or private charging infrastructure, but it may aid Council's transition where it removes or limits the need for costly Council building and network upgrades.

Future proofing Council buildings and facilities will be particularly important when it comes to Council's electric vehicle transition. Major costs can incur to Council should existing sites require costly carpark trenching and civil works, or a site requires upgrades to upstream grid infrastructure (e.g. transformers, cables or feeder mains). In addition, any required upgrades to grid infrastructure can take time (18-24 months) and any increases in network capacity are allocated by the distribution network service provider (DNSP) on a first come first served basis.

The following goals and targets are proposed for charging infrastructure based on the above rationale:

Goal:
Dubbo Regional Council plans for, installs and maintains appropriate charging infrastructure aligned to Council's Zero Emission Fleet Strategy goals and targets.

Target:
Dubbo Regional Council installs and maintains at least 10 'smart' Level 2 AC fast chargers (7-22 kW) for its fleet by December 2025.

3. Implementation Plan

The Strategy lists a number of key strategic outcomes that must be achieved for Council to reach its desired goals and targets, and the Implementation Plan contains specific actions for implementation to ensure these strategic outcomes are achieved.

A copy of the *draft Zero Emissions Fleet Strategy and Implementation Plan*, including proposed strategic outcomes and actions, is attached for your review.

Planned Communications

Once endorsed by Council the draft Dubbo Regional Council Zero Emissions Fleet Strategy and Implementation Plan will be placed on public display for a period of 28 days.

Timeframe

Key strategic goals, outcomes and actions will need to be incorporated by relevant Directors and Managers into Council's four year Delivery and one year Operational Plans once approved.

Next Steps

1. That the draft Dubbo Regional Council Zero Emissions Fleet Strategy and Implementation Plan be endorsed by Council for the purposes of public consultation.
2. That the draft Dubbo Regional Council Zero Emissions Fleet Strategy and Implementation Plan be placed on public display for a period of 28 days.
3. Following completion of public display a further Report, including the results of the public consultation, be provided to Council for consideration.

APPENDICES:

1⇩ Draft DRC Zero Emissions Fleet Strategy and Implementation Plan

2⇩ Final - Dubbo Regional Council Zero Emissions Fleet Roadmap and Action Plan

DUBBO REGIONAL COUNCIL

Zero Emissions Fleet Strategy and Implementation Plan

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1 Introduction

The *Dubbo Regional Council Zero Emission Fleet (ZEF) Strategy and Implementation Plan* is designed to support and guide Council in reducing greenhouse gas emissions associated with its fleet operations.

A zero emissions fleet includes vehicles that do not emit any greenhouse gas emissions, such as battery electric (BEV) and hydrogen fuel cell electric vehicles (FCEVs). The transition to a zero emissions fleet can include hybrid electric (HEV) and plug-in hybrid electric (PHEV) vehicles, which utilise both fuel and electricity, and seek to lower fleet emissions but are not zero emissions. The benefits of transitioning to a zero emissions fleet include reduced greenhouse gas emissions, improved air quality, less noise, and lower running costs than conventional vehicles as a result of decreased fuel and servicing costs.

While zero emissions vehicle (ZEV) charging will increase electricity demand, emissions from vehicle charging will fall as Council increases the proportion of its electricity from renewable sources. In addition, any hydrogen procured for fuel would need to be produced from renewable energy sources to remain a zero emissions option.

The *ZEF Strategy and Implementation Plan* consists of four parts as outlined below:

Part 1: Council Roadmap (Evenergi)

This Roadmap provides the overall context for the *ZEF Strategy and Implementation Plan* and has been developed on behalf of Council by Evenergi, a consultant specialising in assisting organisations to plan, implement and transition to zero emission fleet operations. It also assesses the feasibility of the transition for Council including understanding what vehicles can transition and when, and what costs and resources would be required.

Part 2: Strategy

This section uses the information collected in Part 1 to outline Council's strategic vision, goals, targets, and outcomes for the management of Council's fleet.

Part 3: Implementation Plan

This section contains specific actions for implementation to ensure the strategic outcomes in the Zero Emissions Fleet Strategy are achieved.

Part 4: Monitoring, Reporting and Review

Part 4 describes how the *ZEF Strategy and Implementation Plan* will be monitored, reported and reviewed.

2 Council Roadmap

2.1.1 Development of Roadmap

In December 2020 Council engaged Evenergi to assist Council to plan, implement and transition to zero emission fleet operations. Evenergi's main role was to aid Council in better understanding the business case and roadmap for transitioning to a zero emissions fleet. The final Roadmap (the Roadmap) submitted to Council in August 2021, has assisted Council in the development of this Strategy.

In particular, the Roadmap examined and provided commentary around:

- The importance of transitioning to a zero emissions fleet
- International, national and state legislative policy
- Predicted trends for Australia in 2025, 2030 and to 2050
- Barriers or challenges in transitioning to a zero emissions fleet
- Council's existing fleet operations
- Fleet transition analysis of both light and heavy vehicles
- Vehicle procurement and management
- Infrastructure procurement and management
- Key Enablers, including governance, policies, procedures and financing
- Key Recommendations, including suggested action pathways.

2.1.2 Key Findings

2.1.2.1 The business case for Council to transition is strong

The Roadmap concludes that there is a very strong business case for transitioning to a zero emissions fleet. The Roadmap examines the key environmental, economic and social drivers for change as it applies to Dubbo Regional Council. These insights are summarised below.

Transitioning to a zero emissions fleet will assist Council to:

- *Reduce fleet operating costs over a 10 year period (2021-2030)*

  The Roadmap included a quantitative fleet transition analysis* to help DRC understand when assets would be technically and commercially suitable for electrification up until 2030. The quantitative fleet analysis estimated a potential reduction of costs from executing a Zero Emissions Fleet Roadmap of up to $2.47 million or 5.5% compared to "business as usual" over the 10 year period to 2030 if the transition is managed appropriately.

- *Mitigate greenhouse gas emissions associated with Council's fleet operations*

  Transport is Australia's third largest source of greenhouse gas emissions, accounting for 17% of total emissions. Council's fuel use (petrol, diesel) currently results in 12% of Council's greenhouse gas emissions from energy consumption (electricity, gas, fuel). By executing a Zero Emissions Fleet Roadmap or strategy the quantitative fleet analysis* estimated a potential emissions reduction of at least 1,760 tonnes CO2 equivalent, or 9% of the combined light and heavy vehicle fleet emissions over the 10 year period to 2030.

**The Roadmap quantitative fleet transition analysis was based on a number of key assumptions at the time, including vehicle availability.*

- *Rank highly amongst other leading local governments striving to achieve net zero emissions*

  The NSW government is aiming to fast track the transport sector to net zero emissions by 2050 and is one of the most progressive Australian states in this area along with the ACT. In recent years local government has also been leading in minimising carbon emissions. Typical initiatives include the integration of zero emission vehicles into local government fleets, installing charging infrastructure in public places, and policy development to promote sustainable transport forms. The Roadmap provides a detailed summary of councils leading in the transition, their initiatives and targets.

2.1.2.3 Council's pathway to transition will continue to evolve

The Roadmap outlines a number of pathways to transition for the light and heavy vehicle fleet. Light vehicles will transition more quickly than heavy vehicles as few 'fit for purpose' zero emissions heavy vehicles are currently available on the market.

The speed at which Council's fleet will transition will increase as electric vehicle technology advances, vehicle availability improves, and costs reduce.

Any strategy or policy developed will need to adapt to these changing conditions. In this light Council has developed a short-term strategy and implementation framework, with revisions to be completed every two years to account for changes in technology and the growing speed of transition expected.

2.1.2.3 Change is inevitable

The Roadmap outlines that the economic opportunity associated with zero emissions fleets (ZEFs) is approaching more quickly than many think with zero emissions vehicles to become the dominant vehicle choice from a total cost of ownership perspective from around 2025 onwards.

The Roadmap also states that the changing nature of global vehicle supply, driven by government mandates in many countries, is likely to introduce risks to 'business as usual' with increasing vehicle prices and lower choice for traditionally powered fleet options.

Preparing adequately with internal planning capability and forward thinking infrastructure investment can protect Council against more expensive reactive measures, with this Strategy and Implementation Plan becoming a key part of Council's forward planning.

2.1.2.4 Incentives exist for early adopters

There are a number of 'once in a generation' incentives being launched by the State Government for those councils willing to transition to a zero emissions fleet, including a reverse auction program to assist fleet managers to close the Total Cost of Ownership (TCO) gap between traditionally powered and zero emission vehicles sooner.

As zero emissions vehicles do approach TCO parity with traditionally powered vehicles, those councils with a refined understanding of zero emission vehicle TCO will have the skills, experience and knowledge to make effective procurement decisions across all assets.

There may be significant jobs and development opportunities for the community in regions that become early adopters through the procurement and public operation of ZEVs, councils are stimulating demand for such vehicles within a region. This will drive demand for broader ZEV charging services, encouraging private investment, driving new jobs and other economic activity.

3 The Strategy

3.1 Strategic Vision / Objective

Dubbo Regional Council plans for, and begins to transition to, a zero emissions fleet.

3.2 Policy Context

The Dubbo Regional Council Zero Emissions Fleet Strategy and Implementation Plan is designed to support and guide Council in planning and beginning to transition to a zero emissions fleet.

Council's requirement for the development of the Zero Emissions Fleet Strategy and Implementation Plan has arisen from Council's adopted Energy Strategy and Implementation Plan 2020 to 2025, which includes a Sustainable Transport goal to "plan for and begin to transition to a zero emissions fleet". This goal is based on the rationale that Council's fuel use (petrol, diesel) currently results in 12% of Council's greenhouse gas emissions from energy consumption (electricity, gas, fuel). Diesel use accounts for 11% of Council's greenhouse gas emissions from energy consumption, and is largely consumed by Council's heavy vehicle fleet. Council's total fleet fuel consumption in 2019/2020 was 1.2 million litres.

While the Strategy supports the direction and outcomes Council would like to achieve, the implementation plan will provide the actions and tasks for achieving the key strategic objectives under the key strategy areas.

The Strategy and Implementation Plan sits below Council's Community Strategic Plan and informs Council's four year Delivery and one year Operational Plans. During the revision of these Plans Council Directors will be required to consider the inclusion of the relevant strategies and actions.

3.3 Key Strategy Areas

The Energy Strategy has been divided into four key strategy areas. The individual strategies include:

1. Light Vehicles
2. Heavy Vehicles
3. Servicing and Maintenance
4. Charging Infrastructure

3.3.1 Strategy Area One – Light Vehicles

Scope:

This strategy area addresses light vehicle selection, procurement and use.

Goal:

Dubbo Regional Council will progressively switch to low or zero emissions vehicles within its light vehicle fleet at the time of renewal, where the total cost of ownership (TCO) is equal to or less than the TCO of the existing traditionally powered vehicle and the vehicle is fit for purpose.

Target:

Dubbo Regional Council aims to transition at least 15% of its light vehicle fleet to low (e.g. hybrid or plug-in hybrid) or zero emission vehicles (battery electric) by December 2025*.

Target	% of Council light vehicle fleet low or zero emission vehicles	Estimated no. and type of low or zero emission vehicles in fleet to reach target	Estimated no. of charging infrastructure to reach target
2023	5%	5 Hybrid Electric (HEV) 2 Plug In Hybrid (PHEV) 3 Battery Electric (BEV)	5 'smart' Level 2 AC fast chargers (7-22 kW)
2025	15%	15 Hybrid Electric (HEV) 3 Plug In Hybrid (PHEV) 7 Battery Electric (BEV)	10 'smart' Level 2 AC fast chargers (7-22 kW)

**Consideration should be given to vehicles with charging capabilities such as vehicle to grid (V2G), vehicle to home (V2H) or vehicle to load (V2L). These technologies however are relatively new and may limit electric vehicle options.*

Rationale:

Council's light vehicle fleet currently contains 171 vehicles, with light commercial vehicles (e.g. utilities and vans) making up around two thirds of the light vehicle fleet. SUVs make up 27% of the fleet, with less than 7% of the light vehicle fleet being conventional passenger vehicles.

Council's light vehicle fleet accounts for **20.9%** of Council's fleet greenhouse gas emissions, with light commercial vehicles contributing to a vast majority of those emissions.

A relatively large proportion of light fleet assets are set for replacement in the coming financial years and provide opportunities for transition.

Figure 6: Age distribution of vehicles in the DRC light fleet

Source: DRC Zero Emissions Fleet Roadmap, Evenergi November 2021

Zero emission vehicles tend to cost more upfront, but become much more cost effective when assessed on the full lifetime costs or Total Cost of Ownership (TCO), rather than solely on the upfront cost. The Roadmap considers TCO 'price parity' as a significant milestone or signal for transitioning to a zero emissions vehicle. This is when it is cheaper to own a zero emissions vehicle, compared to a traditionally powered vehicle, when costs are compared across the lifetime of the vehicle.

In examining the future transition of Council's light vehicle fleet the Roadmap indicates that Council's transition will be staggered as the TCO parity of a 'fit for purpose' low to zero emission vehicle with a traditionally powered vehicle varies greatly between each vehicle segment.

Table 18: When to expect electric vehicles to achieve TCO parity

Asset segment	Estimated TCO parity for EVs	Asset segment	Estimated TCO parity for EVs
Large Passenger	2025/26	Medium SUV	2025/26
Medium Passenger	2024/25	Small SUV	2024/25
Small Passenger	2023/24	LCV Ute	2026/27
Light Passenger	2022/23	LCV Van	2026/27
Large SUV	2026/27	LCV Commuter (Bus)	2026/27

Source: DRC Zero Emissions Fleet Roadmap, Evenergi November 2021

In this regard, Council's Passenger Vehicles and SUVs will transition sooner, with Light Commercial Vehicles (e.g. utilities and vans), which make up the majority of Council's light vehicle fleet and its emissions, not expected to transition until after 2025 where it is predicted zero emission versions of these vehicles are more readily available on the Australian market.

The availability and cost of electric vehicles will be subject to great change in the coming years with significant investment in electric vehicle research and development and Council needs to be ready to adapt. The Roadmap suggests that Council could introduce a number of measures to aid electrification of its light vehicle fleet during this time. An example includes introducing a transitional arrangement for the light vehicle asset replacement schedule such as extending the holding period of existing vehicles by an additional year to take advantage of any improvements in electric vehicle availability and prices overtime. The business case of purchased electric vehicles could also be improved by extending their holding period and through higher utilisation for short trips.

Key Strategic Outcomes:

LV 1	Council prepares a Light Vehicle Fleet Policy aligned to Council's Zero Emission Fleet Strategy goals and targets for light vehicles.
LV 2	Council reviews available 'fit for purpose' low or zero emission vehicles, their associated Total Cost of Ownership (TCO), and updates Council's Light Vehicle Fleet Policy's Vehicle Selection List annually.
LV 3	Council's fleet budget aligns with Council's Light Vehicle Fleet Policy.
LV 4	Council pursues funding opportunities to aid and accelerate its light vehicle fleet transition. Grants assist in closing the Total Cost of Ownership (TCO) gap between zero emission and traditionally powered light vehicle fleet.
LV 5	Council purchases low or zero emissions vehicles according to Council's Zero Emission Fleet Strategy goals and targets and in accordance with the Light Vehicle Fleet Policy.
LV 6	Council staff are aware, and have an operational knowledge of, zero emission vehicles introduced into the light vehicle fleet
LV 7	In accordance with Council's adopted *Energy Strategy and Implementation Plan 2020 – 2025*, Council obtains at least 50% of Council's light vehicle electricity consumption from renewable energy by 2025.
LV 8	Council is aware and knowledgeable of technological advances in zero emissions light vehicles
LV 9	Council partners with like-minded councils to lobby the State and Federal governments to prioritise the transition of light vehicles and investment in solutions to accelerate the transition.

3.3.2 Strategy Area Two – Heavy Vehicles

Scope:

This strategy area addresses heavy vehicle selection, procurement and use.

Goal:

Dubbo Regional Council will progressively switch to low or zero emissions vehicles within its heavy vehicle fleet at the time of renewal, where the total cost of ownership (TCO) is equal to or less than the TCO of the existing traditionally powered vehicle and the vehicle is fit for purpose.

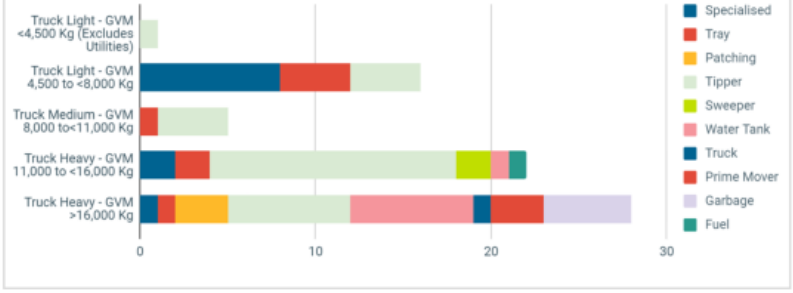
Target:

Dubbo Regional Council trials at least three (3) low to zero emission vehicle within its heavy vehicle fleet by December 2025.

Rationale:

Council's heavy vehicle fleet currently contains 72 vehicles, with the dominant vehicle class being tipper trucks. There is a tendency within the fleet for heavier vehicles, with nearly three quarters of the fleet over 11 tonnes GVM.

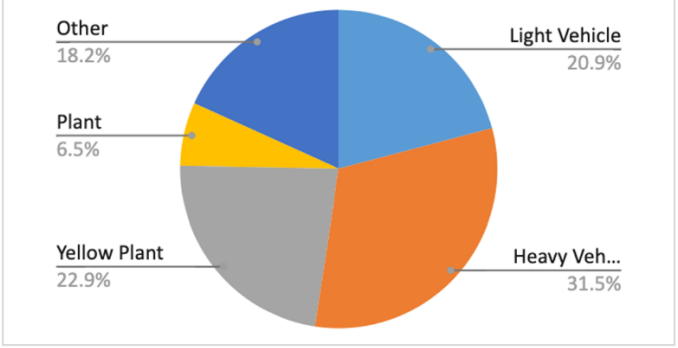
Figure 4: DRC heavy fleet composition by functional type



Source: DRC Zero Emissions Fleet Roadmap, Evenergi November 2021

Council's heavy truck fleet and heavy plant dominate Council emissions accounting for over **60%** of total fleet greenhouse gas emissions.

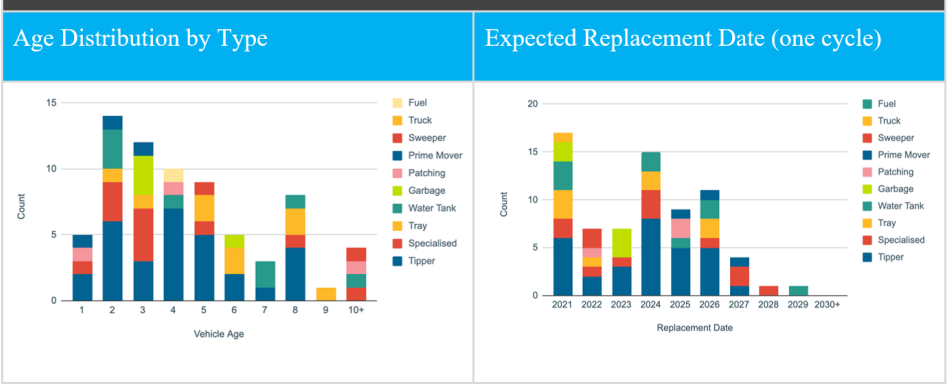
Figure 9: Tonnes of CO_2 emitted per fleet vehicle segment, DRC fleet



Source: DRC Zero Emissions Fleet Roadmap, Evenergi November 2021

A relatively large proportion of heavy fleet assets are set for replacement in the coming financial years

Figure 7: Age distribution of vehicles in the DRC heavy fleet



Source: DRC Zero Emissions Fleet Roadmap, Evenergi November 2021

Depending on the specific use case, the business case for low to zero emissions heavy vehicles and availability of appropriate vehicles is generally poor, which will result in a period of relative inaction for heavy vehicle fleet transition particularly before 2025.

A like for like replacement analysis was conducted part of the Roadmap which concluded that given current technology only 7 heavy vehicles had an operationally straightforward electric option

available on the market at "the time of scheduled replacement" and with a positive Total Cost of Ownership over a ten year period. In addition, the Roadmap concluded that hydrogen powered (Hydrogen Fuel Cell) vehicles are more than ten years from cost-effective fleet operation in a regional setting.

The technical specification, cost and weight improvements expected in the heavy electric vehicle industry over the next 10 years will increasingly improve the business case for electrification of Council's heavy vehicle fleet. Given the significant investments globally in zero emission vehicle R&D, there is also potential for a break-through in operational capabilities sooner than projected.

It is also likely that the Central West Orana Renewable Energy Zone (REZ) may provide some opportunities for Council to invest in hydrogen fuel cell technology should hydrogen infrastructure investment occur within REZ.

Council's heavy vehicle fleet transition pathway prior to 2025 will therefore focus on trialling a number of zero emission options, adopting a pilot and learn approach. A key element of this approach will be ensuring that Council collates relevant data on its heavy vehicle requirements (e.g. payload), and tracks and monitors the performance of any trial low or zero emission heavy vehicles.

Key Strategic Outcomes:

HV 1	Council prepares a Heavy Vehicle Fleet Policy aligned to Council's Zero Emission Fleet Strategy goals and targets for heavy vehicles. The Policy addresses vehicle selection, procurement, and use.
HV 2	Council is aware and knowledgeable of the 'fit for purpose' requirements of its heavy vehicle fleet
HV 3	Council reviews available 'fit for purpose' low or zero emission vehicles, their associated Total Cost of Ownership (TCO), and updates Council's Heavy Vehicle Fleet Policy's Vehicle Selection List annually.
HV 4	Council's fleet budget aligns with Council's Heavy Vehicle Fleet Policy.
HV 5	Council pursues funding opportunities to aid and accelerate its heavy vehicle fleet transition. Grants assist in closing the Total Cost of Ownership (TCO) gap between zero emission and traditionally powered heavy vehicle fleet.
HV 6	Council adopts a 'pilot and learn' approach to its heavy vehicle fleet transition
HV 7	Council staff are aware, and have an operational knowledge of, zero emission vehicles introduced into the heavy vehicle fleet
LV 8	In accordance with Council's adopted *Energy Strategy and Implementation Plan 2020 – 2025*, Council obtains at least 50% of Council's heavy vehicle electricity consumption from renewable energy by 2025.
HV 9	Council is aware and knowledgeable of technological advances in zero emissions heavy vehicles
HV 10	Council partners with like-minded councils to lobby the State and Federal governments to prioritise the transition of heavy vehicles and investment in solutions to accelerate the transition.

3.3.3 Strategy Area Three – Servicing and Maintenance

Scope:

This strategy area addresses vehicle servicing and maintenance of Council's zero emission light and heavy vehicle fleet.

Goal:

Dubbo Regional Council plans for and provides vehicle servicing and maintenance aligned to Council's Zero Emission Fleet Strategy goals and targets.

Target:

Dubbo Regional Council develops a Vehicle Servicing and Maintenance Policy aligned to Council's Zero Emission Fleet Strategy goals and targets by December 2023.

Rationale:

Electric vehicles only have a small number of moving parts that require maintenance, such as software updates, brake fluid, wiper fluid, wiper blades, tyre and wheel alignment and care, air conditioning servicing and the cabin air filter. Major servicing issues such as motor bearing failure and battery degradation are not issues that normally arise in the operational life of electric vehicles, but would be warranty covered items.

In this regard, electric vehicles will require both in house and external servicing and maintenance. Whilst Council may be able to attend to most maintenance requirements at a significant saving over external servicing, any sensor failures and associated error codes will require the vehicle to be sent to a car dealership with access to special IP owned by the vehicle manufacturer. In addition vehicle dealerships may be required for scheduled servicing to ensure warranty compliance, or to address any warranty claims.

The Roadmap indicates that in the early years of transition Council may grapple with the lack of vehicle dealership support, but some local dealers such as Nissan, Kia and Hyundai are working towards electric vehicle readiness in the region.

Council will need to ensure in house maintenance staff attain the skills required, and develop any procedures and policies to ensure a 'safe work environment' when working with electric vehicles.

Key Strategic Outcomes:

SM 1	Dubbo Regional Council prepares a Vehicle Servicing and Maintenance Policy aligned to Council's Zero Emission Fleet Strategy goals and targets.
SM 2	Council in-house servicing and maintenance staff attain the skills required for the transition to a zero emissions fleet
SM 3	Council develops procedures and policies to ensure a "safe work environment" for the transition to a zero emissions fleet
SM 4	Council services and maintains low to zero emission vehicles according to the above Vehicle Servicing and Maintenance Policy

3.3.4 Strategy Area Four – Charging Infrastructure

Scope:

This strategy area addresses charging infrastructure and software selection, procurement, installation, use, servicing and maintenance.

Goal:

Dubbo Regional Council plans for, installs and maintains appropriate charging infrastructure aligned to Council's Zero Emission Fleet Strategy goals and targets.

Target:

Dubbo Regional Council installs and maintains at least 10 'smart' Level 2 AC fast chargers (7-22 kW) for its fleet by December 2025.

Rationale:

The number of chargers required to be installed in the early years of transition is recommended to be "one charger per one electric vehicle" procured until it has been operationally demonstrated that this number of chargers is not required. Council will obtain a better understanding of the required number of chargers through real world experience obtained in the early phases of transition and also the use of telematics.

The type of chargers installed must be 'smart' or controllable chargers to ensure load management systems, which integrate with all chargers on site and regulates their output, can be installed to reduce ongoing energy costs and impacts on the electricity network. Consideration should be given to chargers with vehicle to grid (V2G), vehicle to home (V2H), or vehicle to load (V2L) capabilities however these technologies are relatively new and may limit electric vehicle options in the very near future.

The size of chargers required at these sites will be Level 2 AC fast chargers (7- 22 kW). 7.5kW or 11kW chargers were recommended for the majority of Council's fleet, a step up from the basic home charger, suiting vehicles with stable charging demands such as vehicles doing round trips, with a known location and availability for charging. Only Council's depots (Hawthorne St, Amaroo Drive) were recommended to install a '22 kW' Level 2 AC fast charging charger from 2025 which can provide a faster charging time and suit vehicles with irregular trips and shorter dwelling times. It was not recommended that Council install Level 3 DC Rapid Chargers (e.g. Tesla, NRMA) for its fleet.

The priority location for charging infrastructure will be Council buildings and facilities which house the majority of Council's fleet, such as the Dubbo Hawthorne Street Depot, Wellington Amaroo Drive Depot and the Dubbo Civic Administration Building. However households will also play a critical role with one in three vehicles within Council's fleet considered suitable for home charging (97 of 291 vehicles). Many factors however will need to be considered before Council installs home or private charging infrastructure, but it may aid Council's transition where it removes or limits the need for costly Council building and network upgrades.

Future proofing Council buildings and facilities will be particularly important when it comes to Council's electric vehicle transition. Major costs can incur to Council should existing sites require costly carpark trenching and civil works, or a site requires upgrades to upstream grid infrastructure (e.g. transformers, cables or feeder mains). In addition, any required upgrades to grid infrastructure

can take time (18-24 months) and any increases in network capacity are allocated by the distribution network service provider (DNSP) on a first come first served basis.

Key Strategic Outcomes:

CI 1	Council prepares a Charging Infrastructure Policy aligned to Council's Zero Emission Fleet Strategy goals and targets. The Policy would cover infrastructure and software selection, procurement, installation, use, servicing and maintenance.
CI 2	Council buildings and facilities are future proofed. Council considers and plans for future charging infrastructure requirements at existing, refurbished and new buildings, facilities and carparks.
CI 3	Council determines the feasibility of, and if feasible plans for, future home charging infrastructure required to support Council leaseback vehicles garaged at home.
CI 4	Council ensures operational budgets are aligned to Council's zero emissions fleet transition goals and targets.
CI 5	Council pursues funding opportunities to aid and accelerate the installation of charging infrastructure required to meet Council's zero emissions fleet transition goals and targets.
CI 6	Council has adequate charging infrastructure to meet Council's Zero Emission Fleet Strategy goals and targets.
CI 7	Council staff are aware, and have an operational knowledge of, installed charging infrastructure
CI 8	Council staff attain the skills required for the transition to a zero emissions fleet particularly in relation to servicing and maintaining charging infrastructure
CI 9	Council develops procedures and policies to ensure a "safe work environment" for the transition to a zero emissions fleet particularly in relation to charging infrastructure
CI 10	Council services and maintains installed charging infrastructure according to the above Charging Infrastructure Policy
CI 11	Council monitors advances in, and obtains a better understanding of, charging infrastructure required to support its future low to zero emissions fleet
CI 12	Council partners with like-minded councils to lobby the State and Federal governments to prioritise investment in charging infrastructure within the region.

4 Implementation Plan

This section contains specific actions to be undertaken by Dubbo Regional Council to ensure the key strategic outcomes in the Zero Emissions Fleet Strategy are addressed.

A copy of the Implementation Plan is below.

The delivery timeframe for the Plan will be from when the Zero Emissions Fleet Strategy and Implementation Plan is adopted by the Executive Leadership Team and/or Council until June 2025.

The delivery timeframe is split into three categories and assigned against each specific action.

- Short Term – completion within 1-2 years
- Medium Term – completion within 3-4 years
- Ongoing – a recurring event to be completed on a continuing basis

Strategy Area		Light Vehicles				
Key Strategic Outcomes		**Actions**		**Delivery**	**Funding**	**Responsibility**
LV 1	Council prepares a Light Vehicle Fleet Policy aligned to Council's Zero Emission Fleet Strategy goals and targets for light vehicles.	LV 1.1	Council develops and adopts a Light Vehicle Fleet Policy aligned to Council's Zero Emission Fleet Strategy goals and targets for light vehicles. The Policy addresses vehicle selection, procurement, and use. The Policy also considers the incorporation of measures to aid electrification, such as extended holding periods of vehicles. The Policy includes a Vehicle Selection List or Schedule which is updated and approved annually by the Executive Leadership Team.	Short Term	Fleet & Depot Services	Fleet & Depot Services / Resource Recovery & Efficiency
LV 2	Council reviews available 'fit for purpose' low or zero emission light vehicles, their associated Total Cost of Ownership (TCO), and updates the Light Vehicle Fleet Policy's Vehicle Selection List annually	LV 2.1	Council reviews the available 'fit for purpose' low or zero emission light vehicles, and their associated Total Cost of Ownership (TCO).	Annually	Fleet & Depot Services	Fleet & Depot Services
		LV 2.2	Council updates the Light Vehicle Fleet Policy's Vehicle Selection List or Schedule according to the results of the 'fit for purpose' low or zero emission vehicles review.	Annually	Fleet & Depot Services	Fleet & Depot Services
LV 3	Council's fleet budget aligns with Council's Light Vehicle Fleet Policy.	LV 3.1	Council's fleet budget is updated to reflect Council's Light Vehicle Fleet Policy.	Annually	Fleet & Depot Services	Fleet & Depot Services

Strategy Area		Light Vehicles				
Key Strategic Outcomes		**Actions**		**Delivery**	**Funding**	**Responsibility**
LV 4	Council pursues funding opportunities to aid and accelerate its light vehicle fleet transition. Grants assist in closing the Total Cost of Ownership (TCO) gap between zero emission and traditionally powered light vehicle fleet.	LV 4.1	Council applies for Federal or State Government grants to assist in funding the Total Cost of Ownership (TCO) gap between zero emission and traditionally powered light vehicle fleet.	Short Term	Fleet & Depot Services	Fleet & Depot Services / Resource Recovery & Efficiency
LV 5	Council purchases low or zero emissions vehicles according to Council's Zero Emission Fleet Strategy goals and targets and in accordance with the Light Vehicle Fleet Policy.	LV 5.1	Council purchases low or zero emissions vehicles according to Council's Zero Emission Fleet Strategy goals and targets and in accordance with the Light Vehicle Fleet Policy.	Short to Medium	Fleet & Depot Services	Fleet & Depot Services
		LV 5.2	Council considers purchasing a low or zero emissions vehicle as a "pool car or Council use only vehicle" to allow staff to be familiar with and to gain a better understanding of EV technology.	Short	Fleet & Depot Services	Fleet & Depot Services / Development & Marketing
LV 6	Council staff are aware, and have an operational knowledge of, zero emission vehicles introduced into the light vehicle fleet	LV 6.1	An induction or training course is developed for staff drivers of Council owned zero emission light vehicles.	Medium	Fleet & Depot Services	Fleet & Depot Services/ People, Culture & Safety
		LV 6.1	Staff complete an induction or training course prior to driving Council owned zero emission light vehicles.	Medium	Fleet & Depot Services	Relevant Staff

Strategy Area		Light Vehicles				
Key Strategic Outcomes		**Actions**		**Delivery**	**Funding**	**Responsibility**
		LV 6.2	An educational test drive day (or week) is planned by Council in collaboration with a light electric vehicle retailer to increase staff awareness and operational knowledge of low to zero emission light vehicles.	Medium	Fleet & Depot Services	Fleet & Depot Services/ People, Culture & Safety
LV 7	In accordance with Council's adopted Energy Strategy and Implementation Plan 2020 – 2025, Council obtains at least 50% of Council's light vehicle electricity consumption from renewable energy by 2025.	LV 8.1	As part of Council's electricity contract, Council purchases at least 50% of Council's light vehicle electricity consumption from renewable energy by 2025.	Medium	Organisational Services (Procurement)	Resource Recovery and Efficiency/ Organisational Services (Procurement)
LV 8	Council is aware and knowledgeable of technological advances in zero emissions light vehicles	LV 9.1	Council is a member of local government networks aimed at increasing council awareness and knowledge of technological advances in zero emissions light vehicles	Ongoing	Fleet & Depot Services / Resource Recovery & Efficiency	Fleet and Depot Services / Resource Recovery & Efficiency
LV 9	Council partners with like-minded councils to lobby the State and Federal governments to prioritise the transition of light vehicles and investment in solutions to accelerate the transition.	LV 10.1	Council is a member of local government networks which lobby the State and Federal governments to prioritise the transition of light vehicles and investment in solutions to accelerate the transition.	Ongoing	Fleet and Depot Services / Resource Recovery & Efficiency	Fleet and Depot Services / Resource Recovery & Efficiency

Strategy Area		Heavy Vehicles				
Key Strategic Outcomes		**Actions**		**Delivery**	**Funding**	**Responsibility**
HV 1	Council prepares a Heavy Vehicle Fleet Policy aligned to Council's Zero Emission Fleet Strategy goals and targets for heavy vehicles. The Policy addresses vehicle selection, procurement, and use.	HV 1.1	Council develops and adopts a Heavy Vehicle Fleet Policy aligned to Council's Zero Emission Fleet Strategy goals and targets for light vehicles. The Policy addresses vehicle selection, procurement, and use. The Policy includes a Vehicle Selection List or Schedule which is updated and approved annually by the Executive Leadership Team.	Short	Fleet & Depot Services	Fleet & Depot Services / Resource Recovery & Efficiency
HV 2	Council is aware and knowledgeable of the 'fit for purpose' requirements of its heavy vehicle fleet	HV 2.1	Council conducts a review of its 'fit for purpose' requirements of its heavy vehicle fleet.	Short	Fleet & Depot Services	Fleet & Depot Services
HV 3	Council reviews available 'fit for purpose' low or zero emission heavy vehicles, their associated Total Cost of Ownership (TCO), and updates Council's Heavy Vehicle Fleet Policy's Vehicle Selection List annually	HV 3.1	Council reviews the available 'fit for purpose' low or zero emission heavy vehicles, and their associated Total Cost of Ownership (TCO).	Annually	Fleet & Depot Services	Fleet & Depot Services
		HV 3.2	Council updates the Heavy Vehicle Fleet Policy's Vehicle Selection List or Schedule according to the results of the 'fit for purpose' low or zero emission heavy vehicle review.	Annually	Fleet & Depot Services	Fleet & Depot Services

Strategy Area		Heavy Vehicles				
Key Strategic Outcomes		**Actions**		**Delivery**	**Funding**	**Responsibility**
HV 4	Council's fleet budget aligns with Council's Heavy Vehicle Fleet Policy.	HV 4.1	Council's fleet budget is updated to reflect Council's Heavy Vehicle Fleet Policy.	Annually	Fleet & Depot Services	Fleet & Depot Services
HV 5	Council pursues funding opportunities to aid and accelerate its heavy vehicle fleet transition. Grants assist in closing the Total Cost of Ownership (TCO) gap between zero emission and traditionally powered heavy vehicle fleet.	HV 5.1	Council applies for Federal or State Government grants to assist in funding the Total Cost of Ownership (TCO) gap between zero emission and traditionally powered heavy vehicle fleet.	Short	Fleet & Depot Services	Fleet & Depot Services / Resource Recovery & Efficiency
HV 6	Council adopts a 'pilot and learn' approach to its heavy vehicle fleet transition	HV 6.1	Council purchases a zero emissions heavy vehicle to trial within its fleet in accordance with Council's Zero Emission Fleet Strategy and Heavy Vehicle Fleet Policy.	Medium	Fleet & Depot Services	Fleet & Depot Services
HV 7	Council staff are aware, and have an operational knowledge of, zero emission vehicles introduced into the heavy vehicle fleet	HV 7.1	An induction or training course is developed for staff drivers of Council owned zero emission heavy vehicles.	Medium	Fleet & Depot Services	Fleet & Depot Services/ People, Culture & Safety
		HV 7.2	Staff compete an induction or training course prior to driving Council owned zero emission heavy vehicles.	Medium	Fleet & Depot Services	Relevant Staff

Strategy Area		Heavy Vehicles				
Key Strategic Outcomes		**Actions**		**Delivery**	**Funding**	**Responsibility**
		HV 7.3	An educational test drive day (or week) is planned by Council in collaboration with a heavy electric vehicle manufacterer to increase staff awareness and operational knowledge of low to zero emission heavy vehicles.	Medium	Fleet & Depot Services	Fleet & Depot Services/ People, Culture & Safety
HV 9	In accordance with Council's adopted Energy Strategy and Implementation Plan 2020 – 2025, Council purchases at least 50% of Council's heavy vehicle electricity consumption from renewable energy by 2025.	HV 9.1	As part of Council's electricity contract, Council purchases at least 50% of Council's heavy vehicle electricity consumption from renewable energy by 2025.	Medium	Organisational Services (Procurement)	Resource Recovery & Efficiency/ Organisational Services (Procurement)
HV 10	Council is aware and knowledgeable of technological advances in zero emissions heavy vehicles	HV 9.1	Council is a member of local government networks aimed at increasing council awareness and knowledge of technological advances in zero emissions heavy vehicles	Ongoing	Fleet and Depot Services / Resource Recovery & Efficiency	Fleet and Depot Services / Resource Recovery & Efficiency
HV 11	Council partners with like-minded councils to lobby the State and Federal governments to prioritise the transition of heavy vehicles and investment in solutions to accelerate the transition.	HV 10.1	Council is a member of local government networks which lobby the State and Federal governments to prioritise the transition of heavy vehicles and investment in solutions to accelerate the transition.	Ongoing	Fleet and Depot Services / Resource Recovery & Efficiency	Fleet and Depot Services / Resource Recovery & Efficiency

Strategy Area		**Servicing and Maintenance**				
Key Strategic Outcomes		**Actions**		**Delivery**	**Funding**	**Responsibility**
SM 1	Council prepares a Vehicle Servicing and Maintenance Policy aligned to Council's Zero Emission Fleet Strategy goals and targets.	SM1.1	Council develops and adopts a Vehicle Servicing and Maintenance Policy aligned to Council's Zero Emission Fleet Strategy goals and targets.	Short	Fleet & Depot Services	Fleet & Depot Services
SM 2	Council in-house servicing and maintenance staff attain the skills required for the transition to a zero emissions fleet	SM2.1	Council is aware of the inhouse skills required and courses available for staff in relation to servicing and maintaining zero emissions	Short	Fleet & Depot Services	Fleet & Depot Services
		SM2.2	Council obtain the inhouse skills required for servicing and maintaining zero emission vehicles	Medium	Fleet & Depot Services	Fleet & Depot Services / People, Culture & Safety
SM 3	Council develops procedures and policies to ensure a "safe work environment" for the transition to a zero emissions fleet	SM3.1	Council is aware of the risks of inhouse servicing and maintaining zero emission vehicles	Short	Fleet & Depot Services	Fleet & Depot Services / People, Culture & Safety
		SM3.2	Council develops and adopts procedures and policies to ensure a "safe work environment" when servicing and maintaining zero emissions vehicles	Medium	Fleet & Depot Services	Fleet & Depot Services / People, Culture & Safety
SM 4	Council services and maintains low to zero emission vehicles.	SM4.1	Council services and maintains low to zero emission vehicles according to the above Vehicle Servicing and Maintenance Policy.	Short to Medium	Fleet & Depot Services	Fleet & Depot Services

Strategy Area		**Charging Infrastructure**				
Key Strategic Outcomes		**Actions**		**Delivery**	**Funding**	**Responsibility**
CI 1	Council prepares a Charging Infrastructure Policy aligned to Council's Zero Emission Fleet Strategy goals and targets. The Policy would cover infrastructure and software selection, procurement, installation, use, servicing and maintenance.	CI 1.1	Council develops and adopts a Charging Infrastructure Policy aligned to Council's Zero Emission Fleet Strategy goals and targets for light vehicles. The Policy would cover infrastructure and software selection, procurement, installation, use, servicing and maintenance.	Short	Resource Recovery & Efficiency	Resource Recovery & Efficiency/ Building Services/Fleet & Depot Services
CI 2	Council buildings and facilities are future proofed. Council considers and plans for future charging infrastructure requirements at existing, refurbished and new buildings, facilities and carparks.	CI2.1	Council develops and adopts a Sustainable Building Policy (*as per Council's adopted Energy Strategy and Implementation Plan*) to ensure Council considers and plans for future charging infrastructure requirements at existing, refurbished and new buildings, facilities and carparks.	Short	Resource Recovery & Efficiency	Resource Recovery & Efficiency/ Building Services

Strategy Area		**Charging Infrastructure**				
Key Strategic Outcomes		**Actions**		**Delivery**	**Funding**	**Responsibility**
CI 3	Council determines the feasibility of, and if feasible plans for, future home charging infrastructure required to support Council leaseback vehicles garaged at home.	CI3.1	Council conducts a study into the feasibility of utilising home charging infrastructure to charge Council low to zero emission leaseback vehicles.	Short	Resource Recovery & Efficiency	Resource Recovery & Efficiency/ Building Services/ Fleet & Depot Services
		CI3.2	If feasible Council plans for future home charging infrastructure required to support Council leaseback vehicles garaged at home	Medium	Fleet & Depot Services	Building Services/ Fleet & Depot Services
CI 4	Council ensures operational budgets are aligned to Council's zero emissions fleet transition goals and targets.	CI4.1	Council's fleet budget is updated to reflect chargining infrastructure requirements needed to meet Council's zero emissions fleet transition goals and targets.	Annually	Fleet & Depot Services	Fleet & Depot Services
CI 5	Council pursues funding opportunities to aid and accelerate the installation of charging infrastructure required to meet Council's zero emissions fleet transition goals and targets.	CI5.1	Council applies for Federal or State Government grants to assist in funding the installation of charging infrastructure required to meet Council's zero emission fleet transition goals and targets.	Short	Resource Recovery & Efficiency	Resource Recovery & Efficiency
CI 6	Council has adequate charging infrastructure to meet Council's Zero Emission Fleet Strategy goals and targets.	CI6.1	Council installs charging infrastructure according to Council's Zero Emission Fleet Strategy goals and targets, and in accordance with the Charging Infrastructure Policy.	Short to Medium	Fleet & Depot Services	Building Services

Strategy Area		Charging Infrastructure				
Key Strategic Outcomes		**Actions**		**Delivery**	**Funding**	**Responsibility**
CI 7	Council staff are aware, and have an operational knowledge of, installed charging infrastructure	CI7.1	A charging infrastructure induction or training course is developed for staff drivers of Council owned zero emission vehicles.	Medium	Building Services	Building Services/People, Culture & Safety
		CI7.2	Staff compete a charging infrastructure induction or training course prior to driving Council owned zero emission vehicles.	Medium	Building Services	Relevant Staff
		CI7.3	An education or demonstration day is planned by Council to increase staff awareness and operational knowledge of installed charging infrastructure.	Medium	Building Services	Building Services/ People, Culture & Safety
CI 8	Council staff attain the skills required for the transition to a zero emissions fleet particuarly in relation to servicing and maintaining charging infrastructure	CI8.1	Council is aware of the inhouse skills required and courses available for staff in relation to servicing and maintaining charging infrastructure	Short	Building Services	Building Services
		CI8.2	Council obtain the inhouse skills required for servicing and maintaining charging infrastructure	Medium	Building Services	Building Services
CI 9	Council develops procedures and policies to ensure a “safe work environment” for the transition to a zero emissions fleet particularly in relation to charging infrastructure	CI9.1	Council is aware of the risks of inhouse servicing and maintainenance of charging infrastructure	Short	Building Services	Building Services / People, Culture & Safety
		CI9.2	Council develops and adopts procedures and policies to ensure a “safe work environment” when servicing and maintaining charging infrastructure	Medium	Building Services	Building Services / People, Culture & Safety

Strategy Area		**Charging Infrastructure**				
Key Strategic Outcomes		**Actions**		**Delivery**	**Funding**	**Responsibility**
CI 10	Council services and maintains installed charging infrastructure.	CI10.1	Council staff (or Council's contractor) maintain and service installed charging infrastructure according to the above Charging Infrastructure Policy.	Short to Medium	Building Services	Building Services
CI 11	Council monitors advances in, and obtains a better understanding of, charging infrastructure required to support its future low to zero emissions fleet	CI11.1	Council is a member of local government networks aimed at increasing council awareness and knowledge of technological advances in charging infrastructure	Ongoing	Resource Recovery & Efficiency	Resource Recovery & Efficiency/ Building Services
CI 12	Council partners with like-minded councils to lobby the State and Federal governments to prioritise investment in charging infrastructure within the region.	CI12.1	Council is a member of local government networks which lobby the State and Federal governments to prioritise investment in charging infrastructure within the region.	Ongoing	Resource Recovery & Efficiency	Resource Recovery & Efficiency/ Building Services

5 Monitoring, Reporting and Review

Key strategic goals, outcomes and actions from the Strategy and Implementation Plan must be incorporated by relevant Directors and Managers into Council's four year Delivery and one year Operational Plans.

In this light any progress achieved against the Strategy and Implementation Plan will be reported on by the Responsible Council Officer through the standard Council Integrated Planning and Reporting process:

- Progress Reports - Every Six Months
- Annual Report - Annually (November)

A detailed strategic review of the Strategy and Implementation Plan will then be completed by December 2024.

AUGUST 2021

DUBBO REGIONAL COUNCIL

ZERO EMISSIONS FLEET ROADMAP

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Executive summary

On 24 February 2020 Dubbo Regional Council adopted an *Energy Strategy and Implementation Plan 2020 – 2025* for its operations with the vision of becoming a leader in regional New South Wales in the reduction of energy consumption, increased energy efficiency and the continued adaptation to, and use of, renewable energy.

Council's Sustainable Transport goal, to "plan for and begin to transition to a zero emissions fleet", is based on the rationale that Council's fuel use (petrol, diesel) currently results in 12% of Council's greenhouse gas emissions from energy consumption (electricity, gas, fuel). Diesel use in particular accounts for 11% of Council's greenhouse gas emissions from energy consumption, and is largely consumed by Council's heavy vehicle fleet. Council's total fleet fuel consumption in 2019/2020 was 1.213 megalitres.

A zero emissions fleet includes vehicles that do not emit any greenhouse gas emissions, and includes plug-in hybrid electric (PHEV), battery electric (BEV) and hydrogen fuel cell electric vehicles (FCEVs). In addition to zero emissions, other benefits in transitioning to a zero emissions fleet include improved air quality with vehicles generally cleaner to run, less noise as they are quieter, and lower running costs than conventional vehicles as a result of decreased fuel and servicing costs.

While zero emissions vehicle (ZEV) charging will add to demand for electricity, emissions from vehicle charging will fall as Council aims to increase the proportion of its electricity sourced from renewable resources. In addition, any procurement of Hydrogen for fuel would strictly need to come from renewable sources to remain a zero emissions option.

Council's Energy Strategy and Implementation Plan 2020 – 2025 outlines a number of key strategic outcomes to meet its Sustainable Transport goal (Goal 3) including:

Table 1: Strategic outcomes to meet its Sustainable Transport (3) goal

Strategic outcome #.	Strategic outcome description
3.1	Council understands current fleet practices and the opportunities available to reduce fleet fuel use, mileage, greenhouse gas emissions and fleet size without compromising on service delivery.
3.2	Council implements practices to optimise current fleet performance, reducing fuel use and greenhouse gas emissions.
3.3	Council understands, and develops the business case for, transitioning to a zero emissions fleet.
3.4	Council implements actions towards transitioning to a zero emissions fleet.

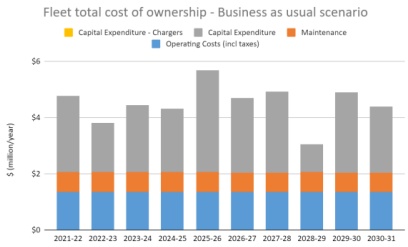
The development of Zero Emissions Fleet Roadmap is a requirement of *Key Strategic Outcome 3.3*, and associated *Action 3.3.1*, which states that Council will develop a *Transition to EV Roadmap (or similar) in order to understand how to, and build the business case for, transitioning to a low or zero emissions fleet.*

Action plan overview

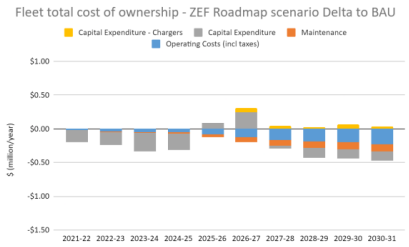
The quantitative analysis outlined potential reduction of emissions from executing a Zero Emissions Fleet Roadmap of 1,760 tonnes CO2 equivalent, or 9% of the combined light and heavy vehicle fleet emissions over the 10 year period. Under the Optimised Zero Emissions Fleet Roadmap the results showed reduction of emissions to be 2,138 tonnes CO2 equivalent, or 11.1% reduction of the combined light and heavy vehicle fleet emissions over the 10 year period.

Figure 1: 10 year total cost of ownership and year of transition

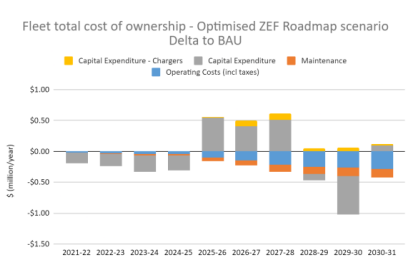
Business as usual scenario



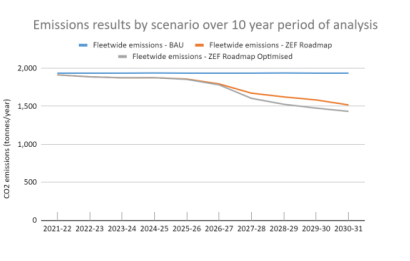
ZEF Roadmap scenario budget impact



Optimised scenario budget impact



Emissions results by scenario



Some of the key opportunities and challenges identified in this report were:

- **Challenge:** The business case for low and zero emissions fleet vehicles is not currently effective for many assets, potentially resulting in a period of relative inaction.
- **Challenge:** Identifying fit for purpose vehicles for replacement of existing assets against a maturing heavy electric vehicle market.
- **Challenge:** All heavy vehicles have a technical fit for purpose match for average duties, but for several days where double shifting is required render the vehicle technically infeasible for transition.

- **Challenge:** Moving from fleet practices that optimise traditionally powered vehicle ownership, to those that optimise electric vehicle ownership, such as longer holding periods.
- **Challenge:** There will be benefits to investing earlier in the core cabling, conduits and Distribution Boards throughout a site, but these costs will make the earlier installations appear less cost effective.
- **Opportunity:** There is an opportunity for Council to make significant fleet cost savings by moving away from larger vehicles towards smaller vehicles, which offer improved TCO, lower emissions and a more beneficial commercial business case for electrification..
- **Opportunity:** The technical specification, cost and weight improvements expected in the heavy electric vehicle industry over the next 10 years will increasingly improve the business case for electrification.
- **Opportunity:** The cost to manufacture battery electric vehicles is set to be lower than traditionally powered vehicles by 2025 for smaller vehicles and by 2029 for larger SUVs. The electrification journey from this period is not likely to include technical or commercial barriers.
- **Opportunity:** The NSW Government's Electric Vehicle Infrastructure and Model Availability Program offers an opportunity to plug the business-case gap in the short term, offering charging and vehicle subsidies for successful bidders. Local government's are eligible for this grant program.

Table 1 - Timing of vehicle availability and pricing over time			
	2021	2025	2030
Utes	Market very limited. Viability dependant on specific asset. **$$$$**	Market established. Viability dependant on specific asset. **$$**	Many options exist. Good viability in most use cases. **$**
Passenger vehicles & SUVs	Some options within market rapidly maturing. Viability dependant on specific asset. **$$**	Many options exist. Improving viability and viable in many use cases. **$**	Many options exist. Good viability in most use cases. **$**
Light commercial	Market established for small vehicles.. Viability dependant on specific asset. **$$**	Market established in all sizes. Viability dependant on specific asset. **$$**	Many options exist. Good viability in most use cases. **$**
Heavy vehicles	Viability dependant on specific asset. **$$**	Viability dependant on specific asset. Technical limitations are diminishing. **$$**	Many options exist. Viability dependant on specific asset. Technical limitations are diminishing. **$**
Heavy Plant	Market established for a few types only. Viability dependant on specific asset. **$$$$**	Market options improve. Viability dependant on specific asset. **$$$**	Market options improve. Viability dependant on specific asset. **$**
Light Plant Equipment	Viability dependant on specific asset. **$$**	Viability dependant on specific asset. **$$**	Many options exist. Good viability in most use cases. **$**

$$$$ = Very expensive, not economically practical
$$ = Capital intensive but potentially viable on TCO
$ = Viable in most cases on TCO

Vision and targets for Council's ZEF Roadmap

The following table presents a vision of the zero emissions fleet roadmap at short, medium and long term horizons, along with suitable associated targets to make the vision a reality.

Vision and targets for ZEF Roadmap scenarios	
Phase	**Key actions**
Horizon 1 : *Immediate actions - to 2022/23*	• New policies and vehicle selection criteria • Heavy vehicle trial • Apply or NSW grants • Driver education
Horizon 2 : *Intermediate actions - to 2025/26*	• New asset budgeting approach • Re-train mechanics • Attract public charging infrastructrure providers • Asset and depot masterplan accounts for future Council electrification plans
Horizon 3 : *Ultimate actions - to 2030/31*	• Normalisation of vehicle procurement and fleet usage based on wider adoption and integration of zeo emission vehicles into the fleet • Advocate for fleet incentives and FBT exemptions for EVs

The following presents a short term plan for the next 3 years. The range of choice and prices should continue to improve each year. The stretch is an alternative plan to the recommended minimum. With a focused plan council will be in a position to capitalize on future reductions in PHEV & EV prices as they occur and trial PHEVs & EVs prior to higher uptake which may become economically the best choice prior to the middle of the decade.

Short term fleet acquisition plan by year			
Year	2021	2022	2023
Theme	*Hybrid/PHEV light vehicle trials*	*PHEV/EV light vehicle trials*	*EV light vehicle trials*
Recommend minimum EV/electric asset rollout	Hybrids for all well utilized medium SUVs (10 medium SUVs to be replaced, 2 at least to hybrid)	Hybrids for all well utilized medium SUVs (8 medium SUVs to be replaced, 3 at least to hybrid/PHEV) 2 PHEV medium SUV in lieu of hybrid	Hybrids for all well utilized medium SUVs (9 medium SUVs to be replaced, 4 at least to hybrid/EV) 2 EV medium SUVs in lieu of hybrid

		Chargers to support 2 PHEVs at locations	Chargers to support additional EVs at locations
Budget required In addition to ongoing replacement (light vehicles + charging equipment)	Minimum 2 x Hybrid Total (add capex) = 6k TCO = neutral	Minimum 1 x Hybrid + 2 x PHEV+2 chargers Total (add capex) = 44k TCO =18k over 5 years	Minimum 2 x Hybrid + 2 x EV +2 chargers Total (add capex) = 80k TCO = 28k over 5 years
Stretch target	2 PHEV medium SUVs including 2 x chargers.	2 EV SUVs instead of PHEVs including 2 x chargers. Additional hybrids Trip analysis and operational planning of EV sweeper. (Note 6)	1 Additional EVs including 1 x chargers. 1x EV sweeper to replace #2166 1 x charger Additional hybrids Expand role out to other categories (ie large SUVs) subject to market availability
Budget required In addition to ongoing replacement (light vehicles + charging equipment)	Stretch 2 x PHEV +2 chargers Total (add capex) = 41k TCO = - 18k over 5 years	Stretch 4 x Hybrid + 2 x EV +2 chargers Total (add capex) = 86k TCO = 28k over 5 years	Stretch 5 x Hybrid + 3 x EV +3 chargers Total (add capex) = 126k TCO = 42k over 5 years Stretch (Heavy vehicles) 1 x EV sweeper + 1 charger Total (add capex) = 232k TCO = -34k over 7 years (potential saving)
Budget required In addition to ongoing replacement (heavy vehicles + charging equipment)	-	-	

Note 1. Based on current pricing. Price monitoring is recommended on these vehicles as they will likely decline in the future and the case presented above should improve year on year.
Note 2. Hybrid $3k per vehicle (additional capex). For high utilisation (i.e 25000 to 30000 kms annually) TCO is neutral.
Note 3. 17k per PHEV vehicle (additional capex). Annual operating savings between $1200 and $2000 for high utilisation (i.e 25000 to 30000 kms annually).
Note 4. 30k per EV vehicle (additional capex). Annual operating savings between $2500 and $4000 for high utilisation (i.e 25000 to 30000 kms annually).
Note 5. This table excludes infrastructure costs but includes charging equipment.
Note 6. The sweeper transition is not straightforward and requires further analysis of existing operations as it may require in some instances secondary daily charges.

The Dubbo light vehicle fleet consists mainly of SUVs and Utes. Most of the SUVs in the fleet are medium sized. Given that low emission options in the ute market are limited and very expensive council should focus on the medium SUV market (a subset of the passenger and suv market that is well represented in Dubbo's existing fleet) which is one currently with good hybrid, PHEV and soon EV choices.

Table 2: SUV - Example of vehicle availability in SUV market

	ICEV	BEV	PHEV	HEV
Currently Available	Toyota Rav 4 Mitsubishi Outlander Mazda CX-5 Subaru Forester Hyundai Tucson Kia Sportage	Audi E-tron	Mitsubishi Outlander	Toyota Rav 4 Subaru Forester
Future Prospects	As above	Hyundai IONIQ 5 Kia EV6 Tesla Model Y	BMW X3	Kia Sportage

SECTION 01:

BACKGROUND

1.1 Purpose and scope of the ZEF Roadmap

Council's Energy Strategy and Implementation Plan 2020 – 2025 outlines a number of key strategic outcomes to meet its Sustainable Transport (3) goal including:

- **3.1.** Council understands current fleet practices and the opportunities available to reduce fleet fuel use, mileage, greenhouse gas emissions and fleet size without compromising on service delivery.
- **3.2.** Council implements practices to optimise current fleet performance, reducing fuel use and greenhouse gas emissions.
- **3.3.** Council understands, and develops the business case for, transitioning to a zero emissions fleet.
- **3.4.** Council implements actions towards transitioning to a zero emissions fleet.

The development of Zero Emissions Fleet Roadmap is a requirement of Key Strategic Outcome 3.3 listed above, and associated Action 3.3.1, which states that Council will develop a Transition to EV Roadmap (or similar) in order to understand how to, and build the business case for, transitioning to a low or zero emissions fleet.

This Roadmap covers review of zero emissions fleet options such as plug-in hybrid electric (PHEV), battery electric (BEV) and hydrogen fuel cell electric vehicles (FCEVs) in the context of operations that largely revolve around traditionally powered vehicles. This roadmap explores the total cost of ownership argument for and against zero emissions vehicles for each light and heavy vehicle in the DRC fleet over the ten years to 2031.

With Dubbo Regional Council's (DRCs) Energy Strategy and Implementation Plan 2020 - 2025 (ESIP) as a backdrop, this Roadmap informs Council's strategy, policy and budget decisions and identifies mitigations to the significant barriers to the rapid uptake of zero emissions vehicles in a regional setting. This Roadmap

- Addresses the barriers and the challenges unique to a regional council servicing a large geographical area (7,536 km2);
- Proposes a long term vision;
- Provides a consistent framework and plan for the procurement and management of a zero emissions fleet;
- Provides a framework and plan for the procurement, deployment and management of charging infrastructure across Council sites; and
- Proposes policy direction required to enable successful implementation.

1.1.1 The importance of transitioning to a zero emissions fleet

Transport is Australia's third largest source of greenhouse gas emissions, accounting for 17% of total emissions. This translates to an increase of nearly 60% since 1990[1], with transport emissions bucking the trend and continuing to increase in light of stagnant emissions regulations and increasing demand for transport services. At the local street, increasing emissions from traditionally powered vehicles directly affect the health of the community, the enjoyment of space and commons, and contributes to noise and smog pollution.

Transitioning to zero emissions fleets helps to mitigate the trend towards more and more harmful emissions and creates external opportunities local stakeholders can benefit from. The key benefits and priorities in transitioning to a zero emissions fleet are presented below in terms of economic opportunities, environmental and social drivers and other critical issues.

Economic drivers

The upfront cost of zero emissions vehicles (ZEVs) is generally sufficient to lead to a higher total cost of ownership (TCO) in today's market, despite the lower costs and complexity of operation. As the automotive supply chains of the world invest in increasingly better performing and lower cost components, the economic opportunity associated with zero emissions fleets (ZEFs) are approaching more quickly than many think.

This document has shown that over the 10 year period, zero emissions vehicles will become the dominant vehicle choice from a total cost of ownership perspective, with a clear tipping point around 2025. Prior to 2025 there are a significant number of low TCO-gap vehicle replacements where zero emissions options can be procured at a low cost per kilogram of abated emissions.

On the defensive side of economic considerations, the changing nature of global vehicle supply is likely to introduce risks to business as usual, with increasing vehicle prices and lower choice for traditionally powered fleet options. This is explored further elsewhere in this report. Preparing adequately with internal planning capability and forward thinking infrastructure investment can protect against more expensive reactive measures, with this report becoming a key part of DRC forward planning.

There are a number of reasons to consider taking steps towards a zero emissions fleet, with some of these outlined in the following table.

Table 3: A sample of economic drivers aligned to a ZEF transition

Driver description	Driver detail
Vehicles will have a lower cost of ownership	Although there is an ability to estimate when price parity will emerge between traditionally powered and zero emissions vehicles, some Council assets will reach parity sooner. The high energy demand of heavy electric vehicles means that where fit for purpose some use cases may already exhibit a lower total cost of ownership today.

[1] ttps://www.climatecouncil.org.au/wp-content/uploads/2017/09/FactSheet-Transport.pdf

Once in a generation incentives are being launched	For those that move quickly, the TCO gap may be closed through government incentives in NSW. As zero emissions vehicles approach TCO parity with traditionally powered vehicles, those councils with a refined understanding of ZEV TCO will have gained the internal skills and experience to make effective TCO and fit-for-purpose procurement decisions across all assets. Further opportunities exist to subsidise future-proofing investments at site level by accessing state grant funding to prepare for latter-stage zero emissions fleet infrastructure needs such as trenching, running cables, establishing secure parking and safety requirements, and establishing ideally positioned distribution boards and metering mechanisms.
There may be significant jobs and development opportunities for the community in regions that become early movers	Through the procurement and public operation of ZEVs, local governments are stimulating demand for such vehicles within a region. This will drive demand for broader ZEV charging services, encouraging private investment, driving new jobs and other economic activity.

Environmental drivers

ZEVs provide a pathway for Council to demonstrate its environmental stewardship, by balancing its economic and population growth with management of its carbon footprint. For the latter, ZEVs are particularly relevant for DRC as transport is a significant contributor to overall emissions, and contributes 12% of all energy-related carbon emissions of the council. Additional environmental considerations are shown in the following table.

Table 4: Environmental drivers

Driver	Description
Meeting councils emissions targets	Fuel use (petrol, diesel) currently accounts for 12% of Dubbo council's emissions from energy consumption (electricity, gas, fuel), while diesel lies at 11% of these emissions, consumed mostly by the council's heavy vehicle fleet. ZEVs are a technically and often commercially viable way to minimise these emissions and begin to transition to a zero emissions fleet by 2025, as per DRC's Energy Strategy and Implementation Plan.
Reducing local pollution	ZEVs produce zero emissions while driving and the lifecycle emissions of ZEVs are lower than equivalent vehicles powered by traditional sources.

Peer-group progress and regional political impetus	The NSW Climate Change Policy Framework13 outlines the State's target of reaching net-zero emissions by 2050. This is an aspirational objective and helps to set expectations about future GHG emissions pathways to help others to plan and act. Regional NSW provides national leadership on renewables through local action. Notable examples include: ● Narrabri LGA has a solar PV penetration rate of 41.8% of dwellings (the NSW average is 21%). ● Lismore City Council has a goal to self-generate 100% of its electricity needs from renewables by 2023, and a plan to achieve this was adopted by Council in 2014. ● Coffs Harbour City Council has a goal to source 100% of electricity from renewables by 2030, with interim targets for 2020 and 2025, and a 50% GHG emissions reduction target by 2025. ● The Renewable Energy and Emissions Reduction Plan was adopted by Council in 2015. ● Byron Shire is aiming to reach a "net zero emissions" target, and Byron Bay Council is a signatory to the Global Compact of Mayors. ● Uralla is aiming to be a zero net energy town (ZNET), through the use of energy efficiency, renewables and storage. A 7-10 year timeframe was anticipated for the ZNET target to be achieved when the project was announced in 2014. ● Tweed Shire Council has set a goal to meet 50% renewables for its operations by 2025 and recently committed to more than 1,300 kWp of solar installations through 2019 ● Tyalgum is aiming to be a 100% renewable energy town and to potentially be 'off-grid' ● The City of Broken Hill has a commitment to achieve 100% renewable status by 2030. These and other commitments as illustrated below, clearly highlight the leadership position occupied by local governments in NSW. Many local governments have also signed up to the Cities Power Partnership program (CPP) run by the Climate Council. Example member councils are Parkes, Orange, Bathurst, Wagga Wagga, Muswellbrook, Upper Hunter Shire and Broken Hill.

The current generation of ZEVs has higher embodied emissions (the emissions incurred for initial construction of the vehicle) than traditionally powered vehicles, but emissions in vehicle manufacture overall are falling as manufacturers turn their attention towards low-cost renewable energy and net-zero production. The automotive manufacturer Polestar has committed that its upcoming Polestar 0, scheduled for release in 2030, is set to become the world's first mass production carbon-neutral vehicle. Other manufacturers such as Volkswagen meet net zero emissions commitments through offsets such as tree planting.

Social drivers

Councils strive to create social cohesion for their communities, as well as drive growth and a sustainable future. Transitioning to ZEVs provides a unique opportunity for councils to demonstrate

their leadership to their community and reap the social benefits that are associated with transitioning to ZEVs, as shown in the following.

Table 5: Social drivers	
Driver	Description
Council demonstrating leadership to community	A timely increase in ZEVs in the region will communicate that ZEVs are a viable regional option, boosting adoption and affirming DRC as ZEV regional leaders. This puts DRC on the front foot to transform the future of regional transportation and stimulate economic activity.
Supporting Energy Smart Communities	The adoption of green transport will assist in minimising Dubbo's reliance on fossil fuels. The use of fossil fuels is connected to increases in the frequency of extreme weather conditions such as droughts and floods, which are known to threaten the well-being of Dubbo's community, the local economy and agriculture.
National energy security / sovereignty	Australia is currently unable to sustain itself in terms of critical liquid fuel extraction, refinement and storage. These risks are being gradually mitigated through greater local generation of energy through renewable means, and transition of transport to electric transport is a key enabler.
Reduced socialisation of health costs	If Euro 6d was mandated for all newly approved models manufactured from 1 July 2027 and for all new vehicles manufactured from 1 July 2028, the benefit-cost analysis suggested that its adoption would result in avoided health costs of $6.4 billion by 2050.[2]

Other considerations

Further to the drivers listed in the previous sections, there are additional positive externalities that are associated with the transition to ZEVs, as per the content highlighted below.

Table 6: Other considerations driving towards a zero emissions fleet	
Driver	Description
Staff and community health and safety - lower emissions vehicles	ZEVs benefit the health of local residents by taking off the road polluting vehicles , which produce significant volumes of air pollutants that cause a range of health risks, such as cardiovascular and respiratory illness.[3]

[2] https://www.infrastructure.gov.au/vehicles/environment/forum/files/light-vehicle-emission-standards-for-cleaner-air.pdf

[3] https://www.aph.gov.au/DocumentStore.ashx?id=12f27cde-19eb-4172-9b49-5535df0ea741&subId=658469

Staff and community health and safety - lower noise and vibration levels.	ZEVs are quieter and smoother in operation than traditionally powered vehicles, generating less vibration and creating a more comfortable and lower stress driving environment for staff and clients. Quieter vehicles also transform the streetscape, helping to create an improved experience of place for local residents and tourists alike.
Risk in the transition to demand for ZEV related capabilities and jobs displacing the need for traditional fleet skill sets.	Reducing friction by bringing stakeholders along the ZEV journey sooner rather than later is crucial as ZEV deployment requires new specialised jobs and skill sets that must be learned. Upskilling will require some time and for those with jobs that may be threatened by the rise of ZEV uptake, training will be necessary to ensure job security.
Increase in electricity demand, higher variability and an increased uptake of renewable energy sources.	ZEVs can provide new forms of storage, e.g. through excess rooftop solar energy. ZEVs may reduce the incidences of localised grid overvoltage and drive demand during off-peak periods to smooth the demand on the electricity networks.

1.1.2 International, national and state legislative and policy context and responses

International

From an international perspective, the key driver for electrifying fleets is emissions reductions, which presents itself in some manners right through to a local government level. At this level, the overarching Paris Agreement[4] climate change pact. The pact "is a hybrid of legally binding and nonbinding provisions"[5], with national commitments falling into the non-binding category. The pact was signed at the 2015 United Nations Climate Change Conference (COP21), with 195 countries becoming signatories in support of the key objectives of the Paris Agreement, with the following planned:

- A goal to limit the increase in global temperatures to well below 2˚C and pursue efforts to limit the rise to 1.5˚C above pre-industrial levels,
- A commitment to achieve net-zero emissions, globally, by the second half of the century differentiated expectations for developed nations, including Australia, that they will reduce their emissions sooner than developing nations
- A five year review and ratchet process which is likely to lead to more ambitious commitments from countries in the future.
- Allocation of $100 billion in funding per year to developing countries as assistance to their emission reductions.

[4] https://unfccc.int/sites/default/files/english_paris_agreement.pdf

[5] https://www.un.org/sustainabledevelopment/blog/2016/09/the-paris-agreement-faqs/

The transport sector is one the largest contributors of emissions at about 24% of global emissions. Road vehicles including cars, trucks, buses and two- and three-wheel motorcycles account for nearly three quarters of transport emissions.[6]

Generally driven by the need to reduce greenhouse gas (GHG) emissions, nations and the corporate sector often consider transport and vehicles as a clear target for policies for ZEVs. Many countries have introduced vehicle specific emissions reduction initiatives and currently 80% of the global automotive market is covered by some form of CO_2 emissions standard.[7]

Supply side incentives

At an international level, there have been many demand and supply side incentives to drive ZEV uptake to support the private sector and governments of all levels in achieving their emissions goals. The most effective global policies driving ZEV supply have been via emissions standards, with European legislation often driving vehicle OEM investment direction through the most stringent regulations.

The current light vehicle standard requires manufacturers to aim for an average vehicle emission across all vehicles sold under the New European Drive Cycle (NEDC) test. Double credits are available for each electric vehicle sold, with manufacturers able to credit their accounts with two vehicles at zero emissions for each vehicle sold. This nuanced policy space has driven significant investment in accelerating ZEVs to market, with the weight of this policy driving a number of auto manufacturers to commit to ZEV only production in a short number of years, already ceasing development of internal combustion engines.

Australia is a small right hand drive vehicle market that is effectively a receiver of vehicles developed according to the commercial reality of policy drivers of larger Japanese and UK vehicle markets. From 2025, limited R&D investment will mean the range of traditionally powered vehicles available in the Australian market becomes more limited and expensive as competition decreases.

Another increasingly popular trend has been the ban on traditionally powered vehicle sales. Progressive politics led key right hand drive countries such as the UK, Japan and India to announce such measures for the medium term 2030-2035. This trend is reflected in recent public opinion, with an engagement process led on behalf of Infrastructure Victoria[8] recently finding strong support for discontinuation of sales of traditionally powered vehicles in Australia beyond 2030.

[6] https://www.iea.org/topics/transport

[7] https://www.climatecouncil.org.au/wp-content/uploads/2017/09/FactSheet-Transport.pdf

[8] https://www.abc.net.au/news/2021-04-08/the-radical-idea-to-increase-victoria-s-electric-vehicles/100052474

Demand side incentives

ZEV uptake by fleets and private owners overseas has been boosted by incentives such as tax exemptions, toll road discounts, rebates on charging stations and subsidies to reduce upfront purchase costs. The following table displays a non-exhaustive range of international demand side policies to promote ZEV adoption within fleets.

Table 7: Selected international incentives to drive ZEV uptake in fleets

Country	How ZEV policy has helped fleets transition
USA	In the US, buyers are eligible for a $7,500 tax credit on a range of ZEVs, and the incentive expires after an automotive brand eclipses 200,000 sales. In January 2021, President Biden further announced plans to electrify the entire 450,000 vehicle strong government fleet. The commitment is estimated to cost US $S20 billion and transitioning the fleet will ensure demand for US-made materials, components and vehicles while boosting job demand.[9]
UK	The UK Government's Road to Zero strategy set out a commitment to make all central government cars electric by 2030, electrifying at least 25% of the fleet by 2022. Government departments have been provided with detailed guidance on how they can drive the electrification transition in their fleet.
Germany	The German Federal Ministry of Transport has granted 168 'future cheques' worth 90 million euros as part of the Electromobility Directive. These cheques will help local authorities to purchase more than 3,800 electric vehicles and almost 2,000 chargers. This program intends to encourage cities and municipalities to electrify their municipal vehicle fleets, ensure appropriate charging infrastructure, and promote electromobility concepts and research projects.[10]

National

The Commonwealth Government has a non-binding obligation to meet Nationally Determined Contribution commitments pertaining to the Paris Agreement. The Australian transport sector – cars, trucks, public transport, domestic flights and shipping – is Australia's second largest source of greenhouse gas pollution. The sector represents 18% of Australia's annual greenhouse gas pollution.[11]

In late 2020, the Australian Government announced a $72 million Future Fuels Fund that provided details on its electric vehicle strategy. The funding will include support for infrastructure for ZEVs and cars powered by biofuels and initiatives such as vehicle-to-grid (V2G) trials; however, there is no targeted support to encourage the direct uptake of ZEVs.[12]

[9] https://thedriven.io/2021/01/27/biden-commits-entire-us-government-vehicle-fleet-to-go-electric/

[10] https://www.electrive.com/2020/02/12/german-transport-ministry-to-fund-communal-ev-fleet

[11] https://www.uow.edu.au/media/2020/transport-is-letting-australia-down-in-the-race-to-cut-emissions.php

[12] https://thedriven.io/2020/12/15/no-new-initiatives-in-federal-governments-ev-strategy-but-comcar-to-trial-electrics/

Insight:

- Energy security is an escalating issue in Australia. Policies of accelerated ZEV uptake must be countered by policies supporting sovereign or protected importation of energy.
- Australia's fleet of vehicles is increasingly heavier and less efficient, and the impact of transport as a proportion of emissions nationally is escalating. This makes transport a target for programs of government investment, especially those that do not directly reduce demand for traditional fuels, such as investment in infrastructure.
- Australia is a receiver of transport policy of other nations, being particularly affected by European and Japan markets. By 2025, the supply of ZEVs will accelerate strongly as traditionally powered options are reduced.

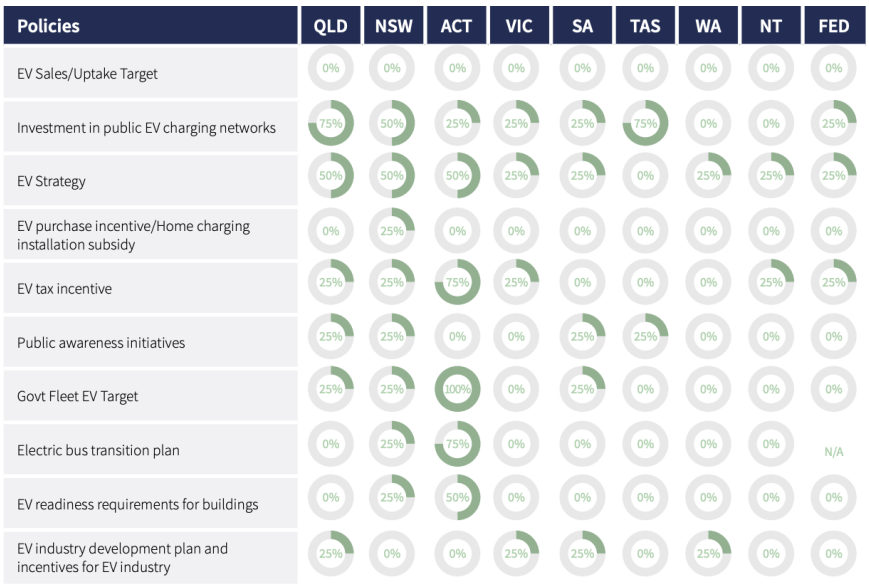
The Future Fuels Fund is regarded by the current government as a key pillar in lowering national emissions. The incentives within the fund can be categorised into the following:

- Assisting the transition of commercial fleets
  - Support businesses to incorporate new vehicle technology into their fleets through the Future Fuels Fund
  - Improving information for motorists and fleets
- Electric vehicle charging and hydrogen refuelling infrastructure
  - Address battery electric vehicle 'charging blackspots' through the Future Fuels Fund
  - Support businesses with charging infrastructure costs to enable fleet uptake
  - Demonstrate hydrogen fuel cell electric vehicle refuelling in more locations
  - Collaborate with states and territories to maximise impact
- Integrating battery electric vehicles into the electricity grid
  - Trial emerging charging technologies through the Future Fuels Fund

State

At a state government level, there is high variability with regards to ZEV uptake. The ACT leads the charge with respect to the policies, followed by NSW. The NSW government has announced its support for a transition to BEVs and is aiming to fast track the transport sector to net zero emissions by 2050. Conversely, Victoria and South Australia have announced taxes on electric vehicles. The below image presents a snapshot and completion status of the available ZEV incentives for all Australian states and territories.

Figure 2: State ZEV policies reviewed by the EV Council[13]



In 2019, the NSW Government realised its Climate Change Policy Framework, which commits to achieving net zero emissions by 2050. This framework outlines the government's role in reducing carbon emissions and adapting to the impacts of climate change. The below table describes the initiatives that promote ZEV market growth and adoption within NSW.

Table 8: NSW Government incentives for low emissions vehicles

Incentive	Description
Developed NSW Net Zero Plan Stage 1: 2020-2030 (2020)	• Developed a plan for NSW's action on climate change to achieve net zero emissions by 2050. • The document describes how the state government will grow the economy, create jobs and reduce emissions over the next decade.
Developed NSW Electric and Hybrid Vehicle Plan (2019).	• Developed a strategy and framework that will drive the future change of sustainable transport.

[13] https://electricvehiclecouncil.com.au/wp-content/uploads/2020/08/EVC-State-of-EVs-2020-report.pdf.

Building fast charging infrastructure to support EV uptake.	● In collaboration with industry and local government, commitment to co-invest in fast chargers: ○ $3 million for regional fast chargers ○ $2 million for chargers in commuter car parks in Sydney ● Announced additional funding for fast chargers through the new EV Infrastructure and Model Availability program.
Financial incentives for fleet owners to drive the transition from ICE to electric vehicles.	● New Electric Vehicle Infrastructure and Model Availability program will include a competitive funding process to co-fund the uptake of EVs in vehicle fleets via: ○ The procurement of EVs; and ○ The deployment of fast charging infrastructure.
Set government EV fleet target	● 30% of all new passenger vehicles to be electric or hybrid by 2023, with at least 10% to be fully electric.
Committed to transitioning all of Sydney's buses to zero emission buses	● Developing a strategy to inform the wider transition to zero emission buses. ● Five electric bus trials are underway in Sydney with further zero emission bus trials being planned in Sydney.
Provide financial incentives	● Provide low emissions vehicles (including EVs) with a 20% discount on light vehicle registration cost.
Assist buyers in understanding the economics of replacing ICE vehicles with low emissions alternatives	● Provided co-funding to the Charge Together Fleets Program to develop a total cost of ownership calculator and an information tool for fleets.

NSW Net Zero Plan

In March 2020, the first stage of the NSW Net Zero Plan covering 2020-2030 was announced with some exciting breakthroughs for the fleet electric vehicle market. Stage 1 aims to enhance the prosperity and quality of life of the people of NSW, while helping the state to deliver a 35% cut in emissions by 2030 compared to 2005 levels. This will be achieved by implementing programs to drive electricity and energy efficiency, increase EV and hydrogen uptake, supporting primary industries, coal innovation, organic waste and carbon financing.

The NSW Government's new Electric Vehicle Infrastructure and Model Availability Program will run competitive funding processes that will co-fund the deployment of fast electric vehicle charging infrastructure. Furthermore, the program will incentivise vehicle fleet owners, including local councils to procure electric vehicles.

The Future Transport 2056 Strategy

The Future Transport 2056 Strategy is a 40 year strategy supported by plans for regional NSW and Greater Sydney with the aim to harness technology to improve customer and network outcomes, beginning with a long term vision for NSW communities. The following table depicts the key takeaways from the strategy, and the strategic relevance in DRC's transitioning to zero emissions

fleets. A table of additional details on the strategic relevance of the Future Transport 2056 Strategy is presented in Appendix J, Addendum 2.

Local government

Over recent years, local governments have been paving the way in minimising carbon emissions. Consequently, the role of local governments has become vital in sparking the transition to greener vehicles in Australia. Typical initiatives include the integrating of ZEVs into local government fleets, installing charging infrastructure in public places, policy development to promote sustainable transport forms and other ZEV related trials.

There are a number of initiatives that local governments can join to provide a framework and peer network assisting the transition away from fossil fuels, including:

- Climate Active (Commonwealth Government)
- Cities Power Partnership (Climate Council)
- Zero Carbon Communities (Beyond Zero Emissions)
- Compact of Mayors (Oceania ICLEI)
- Smart Cities and Suburbs Program (Commonwealth Government)

Numerous local governments in Australia have independently and successfully implemented electric vehicle policies and have overcome the challenges of being first movers to be regarded as and serve as inspiration and experts amongst peers. These governments have taken strategic steps forward, with the focus on developing a transition strategy and taking early steps to gain insights that inform future fleet decisions. This approach mitigates the risks associated with added vehicle and supporting infrastructure complexity.

Most of these early movers are in metropolitain locations within NSW and include City of Sydney, City of Ryde Council, Northern Beaches Council, Canterbury Bankstown Council, Wagga Council, Lismore City Council, Willoughby City Council, Penrith City Council, and City of Newcastle[14].

Local governments leading in the transition to zero emissions fleets include ACT Government and Yarra City Council (Victoria). The ACT Government has electrified the majority of its light vehicle fleet and kicked off heavy fleet trials gathering commercial and operational performance data in partnership with Evenergi. Yarra City Council initiated heavy electric vehicle trials as a true pioneer and has gathered the most comprehensive data on vehicle performance of any fleet locally.

The approach taken by each of the fleets described above involves establishing a transition plan identifying a pathway towards zero emissions vehicles, and actively gathering performance data to improve internal skills for planning and fleet operation.

It is more straightforward in many ways to transition to a zero emissions fleet in a metropolitan scenario, but there are benefits and drawbacks in each case. Larger local government areas involve more travel, with higher annual travel improving the total cost of ownership argument toward zero emissions vehicles. The below table shows selected examples of regional councils with initiatives to transition to electric vehicles.

[14] https://electricvehiclecouncil.com.au/wp-content/uploads/2020/12/EVC-Local-Government-Resource-Pack.pdf

Table 9: Examples of local governments with ZEV Fleet policies			
Local Government	*Population, size (*area)	*Policy or target*	EV experience
Bathurst	43,618[15], 3,321 square km[16]	Smart Bathurst: A Smart Community Strategy	• Bathurst has been targeted as a location for testing driverless vehicles. • Council is also trialling an energy efficient plug-in hybrid vehicle for possible rollout in the Council fleet.
City of Greater Bendigo (Vic)	118,093[17], 287 square km[18]	Community Plan and The Environmental Strategy (One planet framework)	• Fleet transition plan developed by Evenergi to find low emission vehicle (LEV) alternatives for their fleet of approx. 200 light and heavy vehicles.
Lake Macquarie City	*205,901, 757 square km[19]*		• Council has voted to adopt a new EV Charging Strategy with a framework to install EV charging stations across the region. • Council has four EVs in its fleet and has indicated its support for the City's electric future.[20]

It is noteworthy that Dubbo has a history of being on the front foot with fleet electrification trials and knowledge development. An early adopter of the Nissan Leaf electric vehicle in its generation 1 guise encountered economical and operational factors that made it clear the technology of the time was unsustainable for broader fleet application.

The table below shows case studies for councils that have taken meaningful steps towards electrifying their fleets. It is noteworthy that these are all urban councils.

[15] https://economy.id.com.au/bathurst/about

[16] https://www.facs.nsw.gov.au/archive-aho/applicants/era/about/chapters/locations/dubbo

[17] https://profile.id.com.au/bendigo/population-estimate#:~:text=The%20population%20estimate%20for%20the,in%20Regional%20VIC%20was%201.37%25

[18] https://quickstats.censusdata.abs.gov.au/census_services/getproduct/census/2016/communityprofile/2004

[19] https://www.lakemac.com.au/Our-Council/About-us/City-by-numbers

[20] https://thedriven.io/2020/03/25/nsw-regional-council-flicks-switch-on-new-ev-charging-strategy/

Table 10: Carbon Neutral Local Governments with ZEV Fleets		
Government	*Policy*, Target	ZEV experience
Yarra City Council (Vic)	*Yarra Climate Emergency Plan 2020-2024* By 2025, all Council's vehicles to be powered by 100% renewable electricity/zero emissions, where practical options are available	● BEV tip truck trial
City of Melbourne (Vic)	*Climate Change Mitigation Strategy To 2050*	● Current fleet: ○ 10 BEV ○ 18 HEV
Bayside City Council (Vic)	*Climate Emergency Action Plan 2020 - 2025* A staged and costed plan to transition Council fleet to net zero carbon by 2025 is developed and implemented, supported by an updated Fleet Policy	● Victorian EV trial
Moreland City Council (Vic)	*Moreland Zero Carbon – 2040 Framework* Transition fleet to electric vehicles 2020-2025	Largest local government fleet in Victoria: ● 23 BEV
ACT Government	*The Act's Transition To Zero Emissions Vehicles, Action Plan 2018–21* All newly leased ACT Government passenger fleet vehicles will be zero emissions vehicles from 2020–21 (where fit for purpose).	● Electric bus trial ● Current fleet: ○ 17 BEV ○ 7 PHEV ○ 62 HEV
Brisbane City Council (Qld)	*Brisbane. Clean, Green and Sustainable 2017-2031*	Fleet includes: ● 20 BEV, ● 36 HEV passenger, ● 5 HEV trucks. ● Hybrid bus
City of Adelaide (SA)	*Carbon Neutral Strategy 2015 – 2025*	Fleet includes: ● Trial of ZED70 (Toyota Landcruiser) ● 12 HEV ● 35 PHEV
City of Sydney (NSW)	*Climate Emergency Response.* Plan to replace existing garbage trucks with 19 fully electric vehicles	Fleet includes: ● 19 Nissan LEAF ● 40 HEV, ● 70 HEV trucks. ● Trial of BEV garbage truck

Case Study: Yarra City Council

Yarra City council is certified carbon neutral by Climate Active and a member of the Cities Power Partnership. In 2017, the Council was the first to declare a climate emergency and have a clear policy to transition their fleet to zero emission vehicles. Additionally, they aim to reduce the demand on the fleet by encouraging active modes of transport, car sharing and working from home.

Yarra City Council is currently undergoing a number of trials, including:

- A partnership with Transdev to trial electric buses[21]
- A partnership with SEA Electric to trial an electric tip truck[22]
- A trial of electric bicycles

Yarra City Council's policy goals include:

- Converting Council's entire fleet to zero emissions by 2025, subject to availability of suitable vehicles and charging infrastructure/capability
- Converting Council's diesel fleet (i.e. tipper trucks) to electric as soon as possible
- Converting Council's bus fleet to electric by 2023
- Ceasing purchase of new diesel-powered utes until practical electric vehicles enter the market
- Progressively switching to electric or other zero emissions vehicles at the time of renewal where possible, utilising full lifecycle cost budgeting rather than purchase price
- Utilise hybrid options, such as the efficient Yaris hybrid, as a transitional technology where zero emissions vehicles and charging infrastructure are not practical. Phase out non-hybrid petrol driven passenger vehicles by 2022
- Reducing vehicles and their usage through a range of organisational and technical solutions including active transport, online meetings and remote monitoring. Use of telematics will allow Council to better understand the opportunities.
- Ensuring Council's service delivery contractors transition to zero emissions vehicles as quickly as possible (aim for 2026), including street sweeping and kerbside waste collection vehicles
- Participating in sector-leading pilots and trials for new vehicles or zero emissions fuel opportunities, such as using onsite solar and battery storage to power council and contractor electric vehicles
- Being a community leader in staff travel planning and travel behaviour change

[21] https://www.yarracity.vic.gov.au/news/2020/02/05/electric-bus-trial-in-yarra-a-first-for-victoria

[22] https://www.yarracity.vic.gov.au/news/2019/09/12/tipper-truck

1.1.3 Predicted trends for Australia in 2025, 2030 and to 2050

In this section, future technologies are discussed in the context of broader trends:

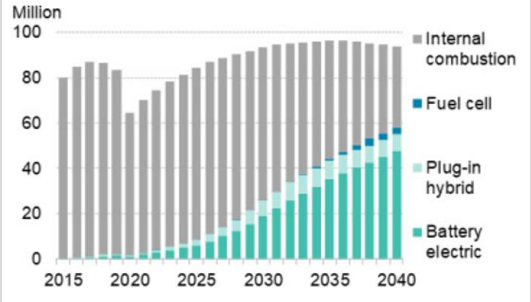
- Near future (to 2025) - The electrification of transport, and
- Mid future (to 2030) - The emergence of Mobility as a Service (MaaS)
- Towards 2050 - Reaching the NSW Net Zero milestone

Near future (to 2025)

Electric vehicles - Disruptive and increasingly competitive

There is an increasing number of ZEV models available and the cost of these vehicles is falling rapidly. The following table is presented from the BNEF Electric Vehicle Outlook 2020:

Figure 3: Passenger vehicle sales projections by drivetrain - BNEF model[23]



ZEVs are currently more expensive to purchase, though lower running costs mean that owning a ZEV can cost less than a traditionally powered vehicle in high mileage applications. For 25,000km/year applications[24], the expected TCO parity is presented in the table below:

[23] BNEF (2020). "Electric Vehicle Outlook 2020."

[24] TCO calculated using 5-year ownership period and 25,000 km annual driving distance

Table 11: When to expect electric vehicles to achieve TCO* parity			
Asset segment	Estimated TCO parity for EVs	Asset segment	Estimated TCO parity for EVs
Large Passenger	2025/26	**Medium SUV**	2025/26
Medium Passenger	2024/25	**Small SUV**	2024/25
Small Passenger	2023/24	**LCV Ute**	2026/27
Light Passenger	2022/23	**LCV Van**	2026/27
Large SUV	2026/27	**LCV Commuter**	2026/27

* Assumes 25,000km/year

Heavier vehicles require larger, more expensive batteries. Vans, utes, and large SUVs are not expected to reach *purchase price* equilibrium until around 2028/29, by which time all light vehicle types are expected to cost less to buy in electric vehicle form.

Charging network maturity

Increasing uptake of ZEVs will drive demand for public charging stations. Although the vast majority of charging is undertaken at home or at the office, the charging network itself can pose a barrier to the widespread uptake of ZEVs. Current occasional barriers with public charging can include:

- Insufficient or inconsistent charging network coverage for trips into regional areas
- Non-optimal charging performance from lower speed chargers
- Underperforming chargers
- Charge network congestion
- Drivers must learn how to operate chargers
- Drivers/operators must schedule charging

These do not represent the typical charging experience, but can be used for planning. The combination of these existing limitations exacerbates issues with the current ZEV user experience.

Technological solutions

The development of technological solutions that reduce or help avoid these barriers are likely to gain market acceptance. These include long range ZEVs, faster charging technologies and falling charging infrastructure cost.

Mid future (to 2030)

The mobility and road transport space is undergoing a transformation that goes beyond electrification. Here we will review the charging technologies that will enable these major trends.

The rise of Connected Automated, Shared Electric (CASE) Vehicles

Key to this sustainable transformation is the application of CASE vehicles across each of the transport sectors, as summarised in the table below.

Table 12: Technology trends of sustainable transport

Transport sector	CASE vehicle application
Personal transport	• Mobility as a Service (MaaS) • Partially/fully autonomous private vehicles
Public transport	• On-demand transport
Logistics/road freight	• Platooning[25] • Driverless vehicles

Automated Vehicle (AV) technology applies an array of sensors in an attempt to navigate safely through an environment with varying degrees of driver input. There are many vehicles currently available with partial autonomy, performing functions such as lane assist, radar cruise control and self parking. It is likely that governments will initially limit AV operation to certain roads using geofencing (via GPS).

It is not easy to understand whether full automated driving capabilities will become prolifically available in the market, due to the complex interaction with human drivers and legal issues arising from who is to blame for injury and death arising from using automated vehicle services.

Toward 2050

The year 2050 marks the year that the NSW Government has committed to achieving zero net emissions in line with all Australian state and territory governments. In the rapidly evolving ZEV industry, there are currently very limited views of the likely trends within the ZEV industry at that milestone year. However, numerous predictions of the ZEV landscape exist on an international and even national level.

In the former case, research by Institute for Energy and Environmental Research (IFEU) cites that the global ZEV market in 2050 will be mature, at expected values of 60% battery electric in the US, 70% in the EU, and over 85% in China[26]. This is supported by the vast number of international initiatives and incentives that are described in the Background information section of this roadmap.

On a national level, several institutions have completed ZEV adoption forecasts for the year 2050, which are summarised below.

[25] (2017). What Is Truck Platooning?, European Automobile Manufacturers Association.

[26] https://blog.evbox.com/volkswagen-emission-free-fleet-2050

Table 13: EV adoption forecasts in Australia toward 2050		
Institution	EV adoption forecast description	Year
ARENA, CEFC and Energeia	• ZEVs represent 70% -100% of the total Australian fleet proportion[27].	2018
CSIRO	• Modelling contains 5 projected sales share scenarios from approx. 40% to 100% [28] [29] • On average, Australians tend to keep vehicles on the road for 20 to 30 years, depending on region • This means it can take 20+ years for sales to translate into fleet share	2020
Energetics	• 40-60% of the Australian car fleet is forecast to be electric and is considered a conservative estimate[30]	2018
Bloomberg New Energy Finance	• By 2040, 40% of all vehicles on the road in Australia will have a plug, and 60% of new car sales will be electric[31]	2018

Note that these forecasts have been carried out using different variables, e.g. using scenarios that include accelerated intervention through government incentives or none at all. Despite the variation in modelling methods, all forecasts show a consistent upward trajectory of ZEV adoption. Further to this, there is consensus that ZEVs constitute the majority of vehicles on the road as well as sales in the year 2050.

In light of this, it is noteworthy that there have been concerns raised that the recent ZEV taxes slated by the Victorian and South Australian state governments will limit the uptake of ZEVs in Australia. Regardless of recent trends, the modelling states that the use of ZEVs will form the fabric of vehicle use in 2050.

Insight: Regardless of the consumer ZEV incentives, consumers are likely to move towards EV ownership. However, opportunities exist for local governments to lead by example by transitioning their own fleets to ZEVs.

1.1.4 Barriers or challenges in transitioning to a zero emissions fleet

As ZEVs are currently not prevalent in Australia, councils that do transition their fleets to ZEV alternatives bear the challenges of first movers. These are barriers as well and suggested solutions are presented in the following section.

[27] https://arena.gov.au/assets/2018/06/australian-ev-market-study-report.pdf

[28] https://thedriven.io/2020/06/18/csiro-says-australias-car-fleet-could-be-fully-electric-by-2050/

[29] aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/Inputs-Assumptions-Methodologies/2020/CSIRO-DER-Forecast-Report

[30] energetics.com.au/insights/thought-leadership/electric-vehicles-will-change-the-world-what-could-it-mean-for-your-business#:~:text=A%20range%20of%20predictions%20for,on%20Australian%20roads%20each%20year.

[31] https://reneweconomy.wpengine.com/australia-starts-slow-on-evs-but-could-overtake-global-market-53680/

High upfront costs and TCO parity

Arguably the most commonly stated concern with regards to ZEV is the perceived high cost. ZEVs tend to cost more upfront, but become much more cost effective when assessed on the full lifetime costs or TCO, rather than solely on the upfront cost.

Battery electric vehicles (BEVs) are much lower cost to operate per kilometre than traditionally powered vehicles via lower energy, maintenance, and repair costs over a vehicle's lifetime. BEVs benefit from established electrical infrastructure relative to fuel cell electric vehicles (FCEVs) which require establishment of a supply and store of compressed pure hydrogen, which increases the upfront cost barrier to use of such vehicles.

Maintenance activities and costs tend to be lower because ZEVs contain hundreds fewer mechanical components that require regular maintenance, such as oil changes, air and oil filter changes, belt replacements and radiator flushes. Frequently consumed items such as brake pads and disks are consumed far less frequently due to the regenerative motor braking strategy employed by ZEVs. Coupled with the fact that EVs contain hundreds fewer parts in a ZEV than an ICE vehicle, repair and maintenance costs are significantly lower with ZEVs.[32]

Another financial barrier is that electric vehicles are a new category in Australia and therefore face more uncertainty with respect to residual values. The limited supply of ZEVs in the market places stress on the secondary vehicle market, and it is not uncommon for a ZEV resell value to be higher than the ATO defined residual value. This supports the previously mentioned argument that the current ATO depreciation methodology for EVs is inaccurate and confusing. Moving forward, it can be expected that the ATO will update the residual value treatment as ZEVs become common in society.

Even though the business case for some fleets already favours ZEVs over ICE vehicles, the industry considers price parity as a significant milestone. This will effectively mean that it is cheaper to own an EV fleet, compared to an ICE fleet. TCO parity is expected for various FCAI segments by 2027 and heavy vehicles by 2029.

Vehicle availability

In Australia, access to ZEVs is limited relative to our global peers. Australians currently have access to 28 different electric vehicle models from 11 different carmakers; in comparison, the UK market has 130 electric vehicles to choose from.

Australia's complex fuel security policy issues have driven retention of older 2009 Euro 5 standards (light vehicles) and Euro V standards (heavy vehicles). Despite this, Australia is a small right hand drive vehicle market that is effectively a receiver of vehicles developed according to the commercial reality of policy drivers of larger Japanese and UK vehicle markets.

It should be expected that from 2025, limited R&D investment will mean the range of traditionally powered vehicles available in the Australian market becomes more limited and expensive as competition decreases. This has contributed to vehicle prices increasing approximately 6% in the last

[32] https://www.nrdc.org/experts/madhur-boloor/electric-vehicles-101

12 months. ZEV options will by this point begin to reach purchase price parity due to their design simplicity, fully mature supply chains and R&D overhead per vehicle reduction.

Another increasingly popular trend has been the ban on traditionally powered vehicle sales. Progressive politics led countries such as the UK, Japan, Norway, India and the Netherlands have announced such measures for the medium term 2030-2035. Bans on traditionally powered vehicles will accelerate price increases and a limitation of choice in the market locally.

The costs involved in manufacturing and taking a ZEV to market are currently higher than for a traditionally powered vehicle, with margins on ZEVs near zero despite their higher price. Until such time as this position reverses, automotive OEMs are incentivised to prioritise the sale of traditionally powered vehicles. While there is some brand-building available to OEMs that launch a limited number of vehicles locally, the commercial incentive is to maximise brand impact and minimise ZEV sales. This has been borne out in Australia with very few ZEVs made available, and those that reach our shore being strictly limited in numbers.

Acceleration of supply of ZEVs will depend on the above commercial factors, as well as government EV policy, market readiness, vehicle technology and capability and the level of public charging infrastructure available. While there is minimal policy support nationally in the way of fuel efficiency standards, consumer incentives and electric vehicle sales targets[33] for local governments adopting ZEVs there is an opportunity to establish alliances with other interested parties in collectively showing growing interest in the demand for ZEVs.

Vehicles in the market suited to fleets

Analysis of the 10-year total cost of ownership driven roadmap to zero emissions vehicles produced no TCO-beneficial scenarios for zero emissions options prior to the 2025-26 financial year. The consequence of this is that the replacement vehicles become more theoretical rather than based on the immediate realities of today's vehicle market. An analysis by FCAI segment was provided to close the information gap in this area, with fleet-centric electric vehicles detailed including:

- Mitsubishi Outlander (PHEV)
- Hyundai Kona (EV)
- Tesla Model 3 (EV)
- MG ZS EV (EV)
- Hyundai Ioniq (EV)
- Hyundai Ioniq (PHEV)
- Nissan Leaf (EV)
- Zero ZED70 (EV)
- Renault Kangoo ZEV (EV)

Charging infrastructure

The Australian AFMA survey showed that fleet managers generally indicate upfront cost was a concern with adopting ZEVs. Local, state and federal governments showed the greatest concern around the need for new infrastructure to support a ZEV fleet[34].

Unlike traditionally powered vehicles that frequent petrol stations, BEVs require charging infrastructure that is often not as easily accessible. It is a new domain that can hide costs and impact business plans.[35]

[33] https://electricvehiclecouncil.com.au/wp-content/uploads/2020/08/EVC-State-of-EVs-2020-report.pdf

[34] https://afma.org.au/electric-vehicles-in-business-fleets-report/

[35] https://rmi.org/insight/steep-climb-ahead/

There are many new factors that must be accounted for by fleet managers when installing charging infrastructure. These include, but are not limited to:

- The availability of appropriate performance and cost chargers;
- Vehicle charging performance vs rated charging power of a charger;
- Site preparation and installation;
- The most effective number and capacity of chargers needed for the fleet;
- Forward planning site load impacts to avoid wasted investment;
- Accurately planning site connection upgrades accounting for local distribution and zone substation capacity;
- Hardware suitability for current and future vehicles;
- The introduction of home charging; and
- How to reimburse ZEV electricity running costs to staff for charges incurred at home.

Completing installation of charging infrastructure in an optimised way that minimises budget impact and maximises vehicle duty-readiness requires upfront planning and an end-to-end view of fleet operations for each user and vehicle. Further details are provided in Section 4 of this report.

Maintenance, repair and services

With new ZEV systems and infrastructure, understanding the requirements of a vehicle's maintenance is important in the transition to ZEVs. Fleet managers with ZEVs in their fleet currently grapple with the lack of maintenance centres and workshops prepared for ZEV repair and maintenance, and this is especially the case in regional areas[36]. Repair and maintenance services can be complicated, and require new and specialised skills and equipment to rectify ZEV related issues, such as the high voltage battery system or regenerative braking.

In and around Dubbo, there are currently several vehicle manufacturers supporting ZEV sales and maintenance. Despite ZEVs needing less maintenance, scheduling of vehicles will remain critical to ensure compliance and safety for staff, and to minimise fleet costs. Further details are provided in Section 2 of this report.

Australian consumer law provides a consumer guarantee that ultimately covers an owner's rights to a repair, replacement or refund as well as compensation for damages and loss and being able to cancel a faulty product or service. To be eligible under the consumer protection guarantee, it is vital that the ZEVs in question comply with OEM service and maintenance requirements.

Duty specific barriers to ZEV adoption

Site specific considerations such as available space to add ZEVs and related charging infrastructure can pose a barrier to fleets operating in tight confines. Shared charging and dual-port chargers can assist to minimise footprint concerns.

Vehicle driving range and charging flexibility are genuine and consistent concerns of fleet managers, especially where there is not a significant body of live experience to work from. Instances where electric vehicles have been commissioned into fleets in an ineffective or poorly managed way can lead

[36] https://www.mdpi.com/2071-1050/12/12/4850/pdf

to the general tarnishing of a technology that may not reflect the reality of current vehicles in the market.

ZEVs are currently range limited relatives to many of their traditionally powered counterparts. At the higher price end of the market this gap does not exist, but for vehicles that are aimed at reaching TCO parity, range is a real factor to consider. Generally a ZEV will cover most if not all of the range requirements of a fleet asset, but there remains a level of heightened concern and a genuine requirement to understand and plan for all eventualities. Section 3 of this document speaks to this requirement for planning, and provides solutions that offer balanced commercial and technical viability.

SECTION 02:

EXISTING FLEET INSIGHTS

2.1 Council's existing fleet operations

The below section provides a summary of existing fleet operations, including a snapshot of Council's existing fleet, fleet costs, fleet utilisation patterns, fleet procurement and energy strategies, and any responses so far in transitioning to a zero emissions fleet.

DRC has a diverse fleet with representation from light passenger and commercial to heavy vehicles performing a wide range of functions. This section will provide an overview of the fleet that will focus on aspects that are relevant to the Zero Emission Fleet Roadmap.

- Vehicle locations
- Fleet composition
- Age distribution and replacements dates
- Vehicle performance by class
- Utilisation patterns
- Emissions

Insights into the duties and movements of the fleet are drawn from the *Fleet List, Fleet Cost, Fleet Utilisation* dataset, fuel datasets, site maps and photographs provided by the Council. The fleet description and performance summary will make use of the Council's system of vehicle attributes as follows:

- Division
- Branch
- Region
- Group (Heavy/Light)
- Vehicle Type (IPWEA Class)
- Body Type (Subclass)

2.1.1 Fleet composition

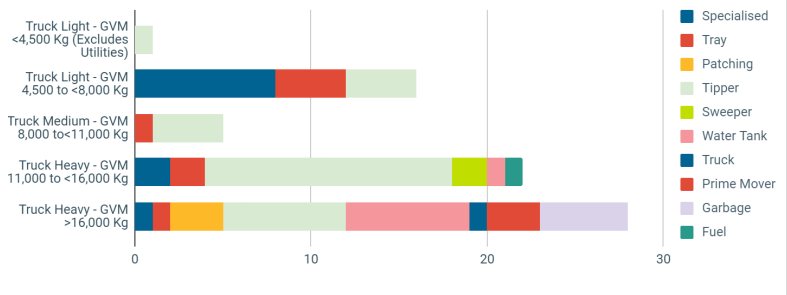
DRC has a diverse fleet with strong representation from light to heavy commercial vehicles, and an in-house service and maintenance function. Around 7 of 10 vehicles in the DRC fleet is a light vehicle, with the fleet boasting 171 light vehicles and 72 heavy vehicles.

Relative to a typical fleet structure, this represents a marginally heavier than typical breakdown. This likely corresponds with the regional nature and large operational area of responsibility serviced by the DRC fleet.

Heavy fleet makeup

The following figure presents DRC heavy fleet composition by functional type. The dominant functional type can be seen to be tipper trucks, while waste, water and tray bodied trucks can be seen as major fleet functions.

Figure 4: DRC heavy fleet composition by functional type

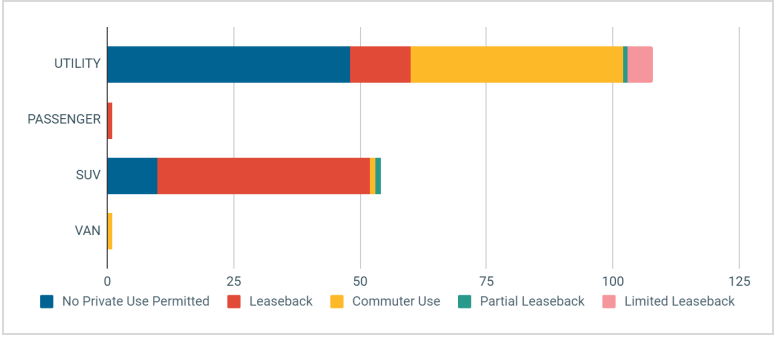


Another key insight from the above representation of the DRC heavy fleet is its tendency towards the heavier end of GVM ranges. Nearly three-quarters of the DRC heavy fleet is over 11 tonnes GVM.

Light fleet makeup

The DRC light vehicle fleet is dominated by utility vehicles in the form of dual-cab utes and single cab utes, making up around two-thirds of the light vehicle fleet. SUVs make up 27% of the fleet, with less than 7% of the light vehicle fleet being conventional passenger vehicles.

Figure 5: DRC Light Fleet Composition by usage agreement



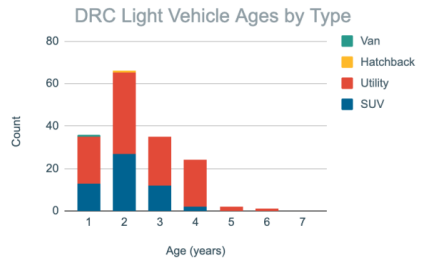
For light vehicles, the usage agreements will also play a large role, since this will determine if vehicles will remain at the Council site or are taken home with staff overnight.

Vehicle age

The following figures present the age and replacement years across light and heavy fleets. It can be seen that there is a relatively large proportion of light fleet assets set for replacement in the coming financial year 2021/22. Financial year 2021/22 also presents a larger than typical replacement cohort for heavy vehicles, representing the highest number of vehicles across any of the out years.

Figure 6: Age distribution of vehicles in the DRC light fleet

Age Distribution by Type



Expected Replacement Date (next cycle)

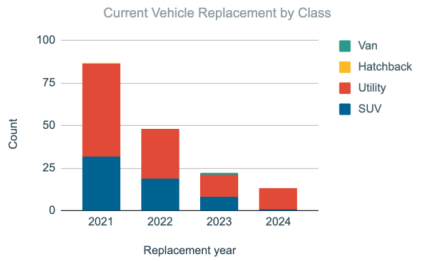
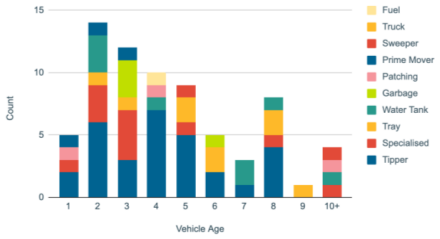
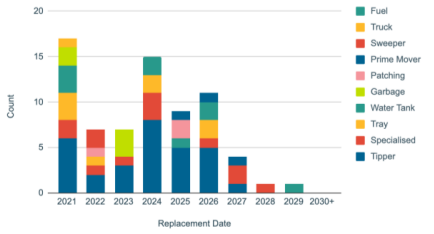


Figure 7: Age distribution of vehicles in the DRC heavy fleet

Age Distribution by Type



Expected Replacement Date (one cycle)



Vehicle emissions

The carbon emissions for DRC for the 2017/18 period were around 2,913 tonnes of CO_2. Fuel from vehicles represents 12% of the total emissions[37].

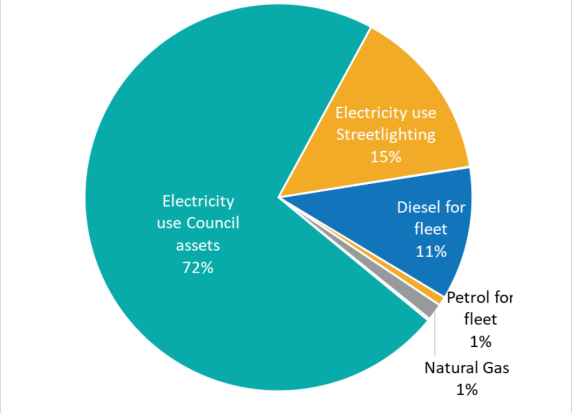
Table 14: Carbon footprint from fuel for FY17/18 in tonnes of CO_{2-e}

Source	Fuel Use	Scope 1	Scope 2	Scope 3	Total CO_{2-e}
Diesel	953.6 kL	2,595	-	132.5	2,728
Petrol	76.1 kL	175.9	-	9.4	185
Ethanol	6.5 kL	0.06	-	-	0.06

[37] DRC Energy Strategy & Implementation Plan 2020 – 2025

The figure below presents DRC carbon emissions by source.

Figure 8: DRC carbon emissions by source [38]



Vehicle emissions in this report are taken from DRC vehicle fuel consumption data and emissions factors from the Department of the Environment and Energy[39]. Emissions factors used in this analysis are provided below.

Table 15: Typical emissions factors for petrol and diesel fuels

Fuel	kg CO_2-e per L fuel
Petrol	2.313
Diesel	2.718

A breakdown of the sources of carbon emissions (CO_2) per fleet segment are presented in absolute and relative terms below for calendar year 2020. It can be seen that the heavy truck fleet and heavy plant dominate council emissions with almost 60% of total fleet emissions.

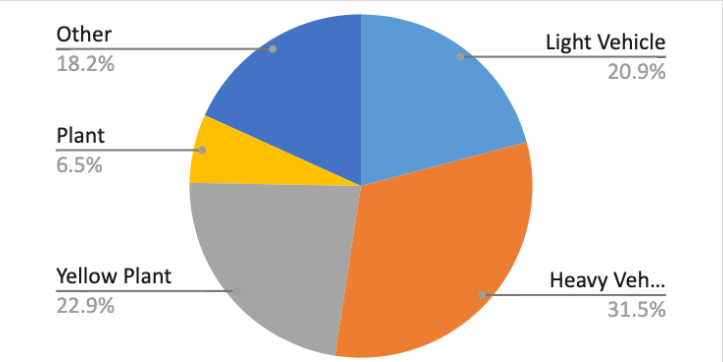
SUV and passenger vehicles emit only a small fraction of total emissions. Light commercial utes and vans contribute to the vast majority of light vehicle emissions, while light vehicles in combination produce 20.9% of total emissions.

While machinery emissions make up 7.6% of total emissions, and in fact more emissions than for SUV and passenger vehicles combined, these are outside the scope of this report.

[38] Source: DRC Energy Strategy & Implementation Plan 2020 – 2025

[39] Source: 2020 National Greenhouse Accounts Factors

Figure 9: Tonnes of CO_2 emitted per fleet vehicle segment, DRC fleet



2.1.2 Fleet utilisation

Fleet productivity can be considered and measured from various angles, but at the highest level it is the ability of the fleet to meet core functional requirements that add value to the organisation in the most economical way. Productivity is affected by the following:

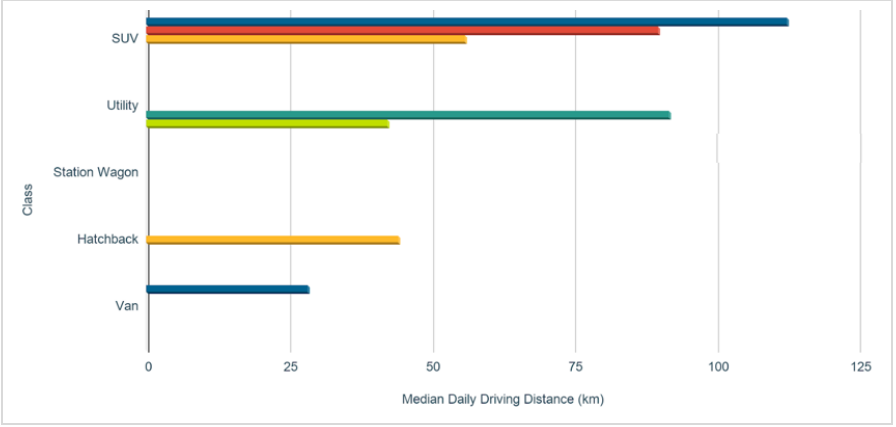
- Vehicle utilisation - a fleet that has more or fewer vehicles than optimal will not be as productive
- Vehicle suitability - a vehicle that is not fit for purpose will force operational changes that cost the organisation productivity (e.g. more labour hours, procurement of more vehicles or suboptimal replacement timing)

A high level summary of vehicle utilisation is provided to inform electrification options. The following considers both vehicle-level utilisation and segment-level utilisation, while assuming existing vehicle fit-for-purpose criteria are met.

Light vehicle fleet performance

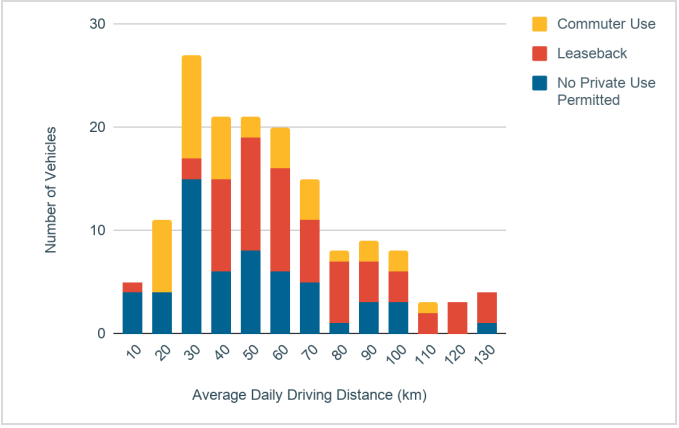
The following summary shows light commercial and passenger vehicles within the DRC fleet along with performance insights. This information has been derived from the provided fuel-card dataset and the fuel information obtained from the fuel card system.

Figure 10: Light vehicle utilisation by category



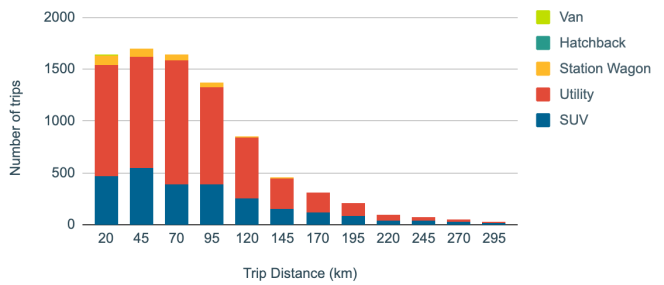
The figure highlights that while utility vehicles make up the majority of the light vehicle fleet, it is the SUV fleet that travels the furthest on a typical day. Passenger vehicles (non-SUV) travel the least distance per day and offer the simplest electrification potential within the light vehicle fleet.

Figure 11: Light vehicle utilisation by usage agreement



The above figure presents distance travelled per day in 10 kilometre-buckets. From this presentation it is clear that vehicles with no private use permitted incur lower mileage, while commuter use and lease-back vehicles travel similar mileage.

Figure 12: Light vehicle trip distribution by class

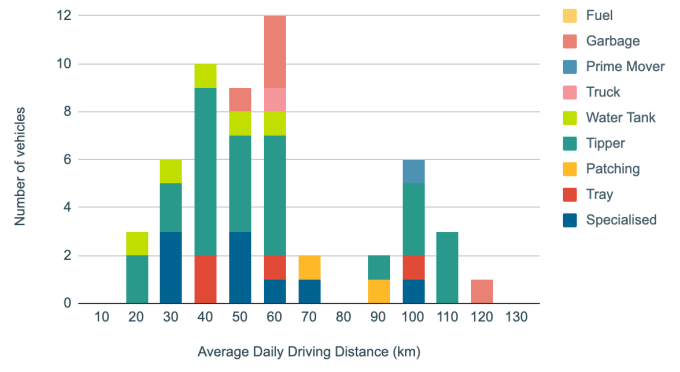


The above figure provides a good insight to the usage pattern of different types of vehicles across the fleet. While passenger vehicles generally cover low travelling distances per day, SUVs and utes can occasionally travel longer daily distances, including at times beyond the capabilities of current ZEVs.

Heavy vehicle fleet performance

The following summary shows heavy commercial vehicles within the DRC fleet along with performance insights. This information has been derived from the provided fuel-card dataset and the fuel information obtained from the fuel card system. The average daily driving distance is presented for each vehicle below.

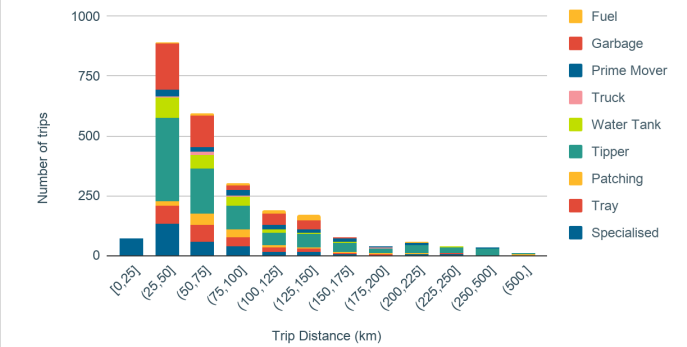
Figure 13: Heavy vehicle average utilisation distribution



It can be seen from the above analysis that daily distance travelled is relatively spread out across the various types of assets, with no general rules able to be derived. Each use case therefore requires a unique understanding of its demands.

The frequency of each trip for every vehicle in the class provides an insight into the volume of trips of each distance. It can be seen below that there are still a significant number of daily trips undertaken by the fleet that exceed the ZEV range of technology currently available.

Figure 14: Heavy Vehicle Trip Distance Distribution



2.1.3 The Council's fleet, procurement and energy strategies

The ZEF Roadmap must tie in with the existing council strategy and policy. DRC has well documented fleet, procurement and energy strategies, summarised in the table below.

Table 16: Documents relevant to fleet procurement

Document Name	Document Description
Management Policy: Fleet Services	Defines the roles of the Fleet and Depot Services Branch and describes the vehicle entitlements and conditions of use for council staff.
Fleet & Depot Services Procedure - Procurement	Describes the process followed in the acquiring and disposal of new vehicles/plant/small plant and equipment.
Government Pricing (Leaseback and Commercial)	List of vehicles with, Approved Vehicle List status and financial details
Whole of Life Costs (Leaseback and Commercial)	Detailed cost breakdown of Director, Manager, Staff level vehicles
Energy Strategy & Implementation Plan 2020 – 2025	Describes the policy framework and objectives to reduce energy consumption, increasing energy efficiency, increasing the use and adoption of renewable energy resources and sustainable transport.

Management Policy: Fleet Services

The "Management Policy: Fleet Services" document defines the roles of the Fleet and Depot Services Branch and describes the vehicle entitlements and conditions of use for council staff. Specifically, this document provides a policy that is relevant to the ZEF Roadmap as follows.

Light vehicles are provisioned according to the different roles in the Council. The importance (beyond functionality) of the light fleet to Council is said to include the attraction and retention of suitable staff in selected positions. This is operationalised as a scale of usage agreements for three levels of seniority in the Council organisation.

There are five DRC fleet usage agreements in operation, as follows:

- Unrestricted Leaseback
- Modified Leaseback
- Limited Leaseback
- To and From Work Only
- Benefit Vehicle (Former Wellington Council)

Each of the above usage agreements identified vehicle usage conditions, access and costs for Council staff. Given the complexity of the number of variations available, this analysis has focused on realised total cost of ownership according to the assumptions presented in Appendix A, Addendum 2.

DRC policy states that all divisions are to utilise the Hawthorn Street (Dubbo) and Amaroo Road (Wellington) workshop resources for servicing and maintenance of all plant, vehicles and equipment. Warranty, maintenance or accident repairs and servicing may be sourced external to either workshop, but remains centrally coordinated.

Fleet & Depot Services Procedure - Procurement

The 'Fleet & Depot Services Procedure - Procurement' document provides a framework for the process of acquiring and disposal of vehicles. The document defines the high-level categories of the fleet into light vehicles, major plant and minor plant.

Key points that are relevant to the Zero Emission Fleet Roadmap are as follows:

- That light vehicles be purchased as opposed to any leasing arrangement
- That utilities rather than passenger vehicles can be purchased where suitable
- That the NSW Government Supply Contract be referenced to allow Fleet and Depot Services the flexibility to determine an appropriate fleet mixture
- A list of motor vehicles which has been identified as suitable replacement vehicles for relevant positions will be compiled and approved by the CEO in July annually
- The list of vehicles will be established having regard to operational requirements, whole of life costs and overall suitability as a Dubbo Regional Council vehicle
- Staff members who salary sacrifice or leaseback Council vehicles will be able to select a vehicle from the approved list
- The procurement procedure defines the vehicle holding periods as 3 years / 60,000km for light vehicles, 4

Table 17: DRC fleet holding terms		
Fleet Category	Time (years)	Distance (km)
Light Vehicles	3	60,000
Commercial	4	80,000
Heavy*	7	200,000
*Not defined in procurement document		

From an environmental perspective, the *Fleet & Depot Services Procedure - Procurement* document states its focus includes:

1. Saving emissions by reducing fuel and energy used by staff in the delivery of services
2. Supporting low carbon modes of transport where an economic scenario is otherwise balanced
3. Working towards the Council having the required infrastructure to transition to efficient, effective and accessible shared low carbon transport options; and
4. Investing ethically and maintaining assets to maximise useful life

Energy Strategy & Implementation Plan 2020 – 2025

The "Energy Strategy & Implementation Plan 2020 – 2025" describes the policy framework and objectives to reduce energy consumption, increasing energy efficiency, increasing the use and adoption of renewable energy resources and sustainable transport. Strategy Area Three outlines the overarching goal of this project:

> **Goal:**
> Council plans for, and begins to transition to, a zero emissions fleet by 2025.

The key strategic outcomes outlined are as follows:

3.1	Council understands current fleet practices and the opportunities available to reduce fleet fuel use, mileage, greenhouse gas emissions and fleet size without compromising on service delivery.
3.2	Council implements practices to optimise current fleet performance, reducing fuel use and greenhouse gas emissions.
3.3	Council understands and develops the business case for transitioning to a zero emissions fleet.
3.4	Council implements actions towards transitioning to a zero emissions fleet.

Whole of Life Costs

The Whole of Life Costs spreadsheets contain vehicle cost breakdowns including fuel consumption, purchase price and depreciation. Vehicles in each class and application are compared graphically, enabling a rapid review of high level total cost of ownership.

SECTION 03:

Fleet transition analysis

3.1 Vehicle procurement

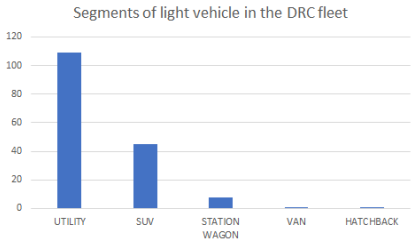
3.1.1 Zero emissions fleet transition overview

The DRC light vehicle fleet is predominantly made up of light commercial vehicles, which break down into the sub-categories of utility (cab-chassis and slab-sided) and vans (commuter bus and cargo-focused). There are also a number of light vehicles designed primarily for moving passengers, broken down into the sub-categories of passenger vehicles (small and medium) and SUVs (large).

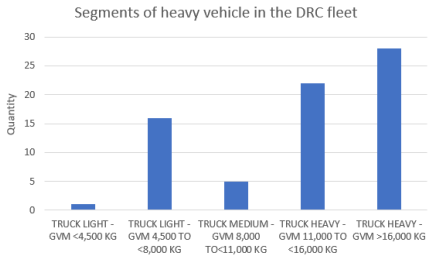
The DRC heavy vehicle fleets undertake a diverse range of duties across the business units of Council. Of the 72 heavy vehicles, 50 of these are above 16 tonnes and considered a 'heavy truck'. A breakdown of heavy vehicles by weight category is presented below, while machinery including tractors, mowers and path sweepers are outside of scope for analysis.

Figure 15: Heavy and light vehicle make-up in the DRC fleet

Light vehicle fleet



Heavy vehicle fleet



3.1.2 Vehicle analysis methodology

The aim of this section is to help DRC understand when assets are technically and commercially suitable for electrification. The methodology we have taken for this task is to identify the vehicle segment for each asset and:

1. Map replacement schedule and emissions for business as usual like for like replacements (lowest TCO)
2. Understand if there are like for like ZEV replacements and the timing for alternatives
3. Understand the current economics of ZEV replacements and model future economics
4. Map replacement schedules and emissions for an accelerated zero emissions option using optimised assumptions for zero emissions vehicles, with altered fleet policies.
5. Create 10 year emissions and financial budgets and present in component form

A like for like analysis assumes the functional attributes of the existing vehicles in the fleet are optimised for the role and the need for the function is certain and cannot be replaced. Only the holding period policy is altered by extending the holding period by one year for the zero emissions fleet optimised analysis. The analysis uses the FCAI vehicle segment for light vehicles to identify matching vehicles for TCO analysis at each scheduled point of replacement.

For heavy vehicles, this analysis uses GVM and payload considerations to identify matching vehicles with a zero emissions drivetrain. This analysis focuses on understanding the diesel energy consumed in operation of each heavy vehicle in the DRC fleet, converting energy consumption to an electrical equivalent. This provides each vehicle with an electrical energy consumption rating that is inclusive of duty-cycle factors and avoids the need to measure and track vehicle payload and overall mass.

A de-rating factor is applied to the energy consumption rating to account for variability of battery performance in cold and hot conditions, and the added relative drain of heating and air conditioning systems. Modelling of energy consumed by heavy electric vehicle replacements to existing fleet assets therefore presents worst case energy consumption.

Key assumptions for heavy and light vehicle TCO modelling are provided in Addendum 2.

Current electric vehicle alternatives

The electric vehicle market is becoming increasingly more mature, with most vehicle manufacturers now presenting the market with at least one electric vehicle option, and with dozens publicly slated for production between now and 2024. While these vehicles are simpler than their traditional contemporaries to design, build, drive and service, they are currently limited in their production volume, and the manufacturing supply chains are immature.

Due to the simplicity of electric vehicles, it is anticipated that by 2026/26, small-medium passenger vehicles will be the same purchase price as traditionally powered alternatives. Heavier vehicles require bigger and more expensive batteries, and so LCV vans, utes, and large SUVs are not expected to reach purchase price equilibrium until around 2028/29, by which time all light vehicle types are expected to cost less to buy as an electric vehicle.

Below is an insight into the estimated total cost of ownership parity point for electric vehicles. This has been based on the 2019 International Council on Clean Transport analysis[40] of numerous leading models of EV purchase price and typical costs of ownership, adjusted to account for smaller vehicles preferred in Australia and an estimated 25,000km annual travel distance. Lower annual travel distances and holding periods shorter than the modelled 5 years will delay the TCO parity point.

[40] https://theicct.org/sites/default/files/publications/EV_cost_2020_2030_20190401.pdf

Table 18: When to expect electric vehicles to achieve TCO parity			
Asset segment	Estimated TCO parity for EVs	Asset segment	Estimated TCO parity for EVs
Large Passenger	2025/26	Medium SUV	2025/26
Medium Passenger	2024/25	Small SUV	2024/25
Small Passenger	2023/24	LCV Ute	2026/27
Light Passenger	2022/23	LCV Van	2026/27
Large SUV	2026/27	LCV Commuter (Bus)	2026/27

Current heavy electric vehicle alternatives

The heavy EV market is relatively immature, with only Fuso and Australian company SEA Electric offering vehicles locally. Internationally, there are relatively few heavy ZEV manufacturers, and these are in the pilot manufacturing and testing phase. Results in the Australian market have been broadly positive and SEA Electric is now a vehicle manufacturer building Hino chassis inhouse with their driveline installed, and does not offer other chassis.

As the ZEV market continues to mature, the price and performance of vehicles will improve. It is anticipated that there will be heavy ZEV market entries from Europe and America from around 2022-2025 that do not extend the operating range potential per charge relative to existing options on the market. It is further anticipated that only low volumes of vehicles will enter the local market over that period and that vehicle purchase prices will remain 'sticky' relative to the theoretical price as supply falls well short of demand.

New model options entering the Australian market are likely to be well represented by what is in development internationally at this time, bringing rapid charging options that reduce the battery size and vehicle cost, while increasing efficiency and enabling rapid recharging. It is likely that by 2025, additional European and American options will be available locally and prices will have decreased from current levels.

It is anticipated that there will be a split into two use-cases offered, with one being those vehicles not intended to meet daily duty cycle requirements on a single charge and the other being those designed to meet all-day usage requirements such as is offered by SEA Electric. A table of heavy EVs available in Australia is provided in Appendix C, Addendum 2.

TCO parity for heavy vehicles can be reached despite the increased cost of acquisition. The nature of heavy vehicles to consume a lot of energy aligns well to the fact that electric vehicles are cost-effective to supply with energy (charge). The threshold is more commonly technical, with excessive energy consumption demands relative to the vehicle battery capacity.

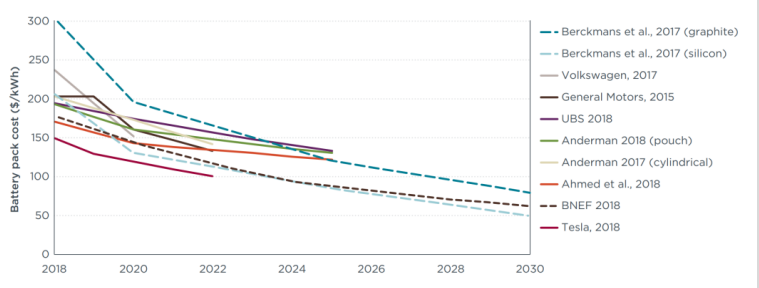
Economic dynamics of heavy vehicles

Electric battery performance has been widely acknowledged as a technical and economic barrier for EVs. Total energy storage capacity and hence the ability to power the vehicle over a demanding duty cycle remains difficult to reconcile, despite advances in technology.

The cost of batteries is the key driver of the high capital costs of heavy EVs, both due to the high cost per kWh and the significant size of the battery required for heavy vehicles. This is exacerbated by the fact that as battery size and weight grows, more of the battery capacity is required just to move the weight of the battery around.

It is widely noted in industry and research that battery price per kWh has been rapidly decreasing from around USD1,000/kWh in 2010, to less than one quarter of that in 2018-19. The latest industry research points the average completed battery pack price being in fact, as low as USD137/kWh, tracking along the lowest estimates from 2018/19 in the forecast below[41]. Forecasts vary, but all agree the trend is expected to continue, with an average price per kWh continuing to decrease the rest of the decade down to around USD65/kWh in 2030.

Figure 16: USD light vehicle batteries per kWh over time



Heavy vehicle battery prices are estimated to be around 2 years behind the industry price curve for high volume light vehicle counterparts reflected in the figure above. In 2018 the battery accounted for almost 35% of the retail price of heavy electric vehicles, moving to around 30% in 2020, and expected to further decrease to 20% by 2025 as total vehicle price reduces.

While European and American heavy EV manufacturers are investing heavily in R&D, they have yet to establish 'normal' vehicle supply, instead providing 'captured' test fleets to major corporations that are willing to accept the performance risk across their organisation in return for close-access and support from the manufacturers. Australia is likely to have difficulty accessing heavy EVs from Europe as while the existing testing is proving successful, vehicle supply will be severely restricted by orders from customers closer to the manufacturing location.

[41] https://theicct.org/sites/default/files/publications/EV_cost_2020_2030_20190401.pdf

DRC fleet driving range requirements

The driving range of electric vehicles is seen as a key consideration when purchasing. On the one hand the vehicle has to deliver the required distance without fear of running out of charge, on the other, greater distances travelled will improve the total cost of ownership.

To determine fleet distance travelled, fuel data was analysed and where quality data was available; average and maximum distance travelled per day was calculated. Where assets are new to the fleet, there may not be sufficient data to determine average distance travelled and so segment-averages have been assumed in lieu of more granular detail.

The typical average distance travelled per day by the DRC passenger vehicle fleet is around 25-150km, with only occasional demands for these vehicles to travel more than 200km per day, and a maximum daily distance travelled of 375km. This compares favourably with current examples of available electric vehicles, including the 230km/charge range of the Battery Electric Vehicle (BEV) Hyundai Ioniq Electric, 270km/charge Nissan Leaf, 262km/charge MG ZS EV and 415km/charge of the Tesla Model 3.

Two specific considerations for electric vehicles are the derating of the battery over time (around 2% of initial rated energy storage is lost from total capacity each year) and the variation in vehicle performance in different conditions. In very cold winter temperatures with the heater on, the effective range of the Hyundai BEV becomes 115km/day, the Nissan Leaf becomes 137km/day and the Tesla Model 3 becomes 211km/day.

> **Myth Buster**
>
> ANCAP ratings for electric vehicles are almost exclusively at the highest possible 5-star rating, evidence that even under extreme crash conditions, electric vehicles remain completely safe.

Hydrogen as a future fuel for heavy vehicles

Many industry voices propose Hydrogen Fuel Cells as a fast approaching technology able to solve the zero emissions range dilemma with higher energy consuming electric vehicles. Experience in NSW through Transport for NSW's expressions of interest process unearthed several very interesting solutions in the Hydrogen technology space, but issues remain.

Hydrogen Fuel Cell vehicles are already capable of performing many duties, including light passenger and commercial vehicle duties and those of heavy vehicles. A Hydrogen Fuel Cell vehicle, depending on specification, can indeed give zero emissions vehicles a similar range to existing diesel powered vehicles.

The core issue for Hydrogen fuelled technologies is that processing and refuelling infrastructure is complex and expensive, with a very large demand for the fuel in one suitable location required. Electrolysis is the process of using electricity to split water into Hydrogen and Oxygen.

Large-scale electrolysis is required to create 'green' (renewably derived) Hydrogen at a price per kilogram that makes Hydrogen fuel make total cost of ownership sense; around $3-$5/kg. Industry commentary around the NSW EOI process indicates electrolyzers in the order of 30MW, producing 15,000kg of Hydrogen per year, are required to reach the circa $5/kg price required to make the business case sensible.

It is not accurate to imply that a $5/kg price of compressed Hydrogen is an adequate target for heavy vehicles in the DRC fleet. A target price below $5/kg is likely required for many if not all vehicles in the DRC heavy vehicle fleet due to relatively mild duty cycles. Hydrogen Fuel Cell truck costs are broadly not available publicly, but commentary from Cleanaway during this project put the cost over the coming few years in the range of $1-1.2 million for a 22 tonne rear load waste truck.

Shipping Hydrogen is an expensive exercise[42], requiring expensive high pressure vessels and significant volume. It is often considered that a commercial Hydrogen refuelling source must be co-located with its generation source to achieve cost-effective prices below $10/kg.

A heavy truck over 16 tonnes driven over the course of a day may consume around 20kg[43] of Hydrogen. To consider Hydrogen as a source of potential future fleet zero emissions energy, a project that can identify 15,000kg of demand from the same refuelling site throughout the year provides an idea of the scale required to make the business case work. It is likely that Hydrogen powered vehicles are more than ten years from cost-effective fleet operation in a regional setting, and so this analysis does not further consider the technology.

The NSW Government is in the planning stage for the state's first Renewable Energy Zone in the Central-West Orana region, around Dubbo and Wellington. The REZ may create an opportunity for Council to assist in the coordination and support of public and private investment in shared Hydrogen infrastructure, potentially benefiting from attractive Hydrogen prices.

3.1.3 Environmental considerations - production to end of life

Vehicle emissions, air quality, and Australia's targets

The transport sector is a major contributor to poor air quality due to noxious emissions generated during vehicles' operations. Oxides of nitrogen (NOx), Oxides of Sulphur (SOx), Oxides of Carbon (COx), Particulate matter (PM), and Hydrocarbons (HCs)/Volatile organic compounds (VOCs); the major pollutants associated with fuel combustion in vehicles, are known to cause respiratory illness, cardiovascular diseases and cancer.[44] Below are listed a number of known effects of vehicles emissions, sourced from links on page:

- CO_2 is the major contributor to global warming and climate change
- CO, a highly toxic gas, reduces the oxygen level in bloodstream and is highly dangerous for people with heart diseases

[42] https://hydrogencouncil.com/wp-content/uploads/2020/01/Path-to-Hydrogen-Competitiveness_Full-Study-1.pdf

[43] https://www.sustainable-bus.com/news/hydrogen-at-scale-for-transit-what-does-it-mean-to-operate-fuel-cell-buses/

[44] https://www.eea.europa.eu/publications/explaining-road-transport-emissions

- HCs and VOCs contribute to the formation of ground-level ozone and petrochemical smog which harms eyes and lungs and causes discomfort
- PM can enter into the highly sensitive respiratory system and can cause cardiovascular and lung diseases including cancer
- NOx contribute to eutrophication and acidification of water and soil
- SOx can cause asthma and chronic bronchitis by affecting respiratory systems, especially lung function. These pollutants can also have a bad impact on plant quality and growth

The lifecycle emissions from electric vehicles

Globally, ZEVs demand has increased over the years due to its role in advancing decarbonisation.[45] Environment and sustainability concerns have always been a core motive behind ZEV-related policy decisions and technology advancements.

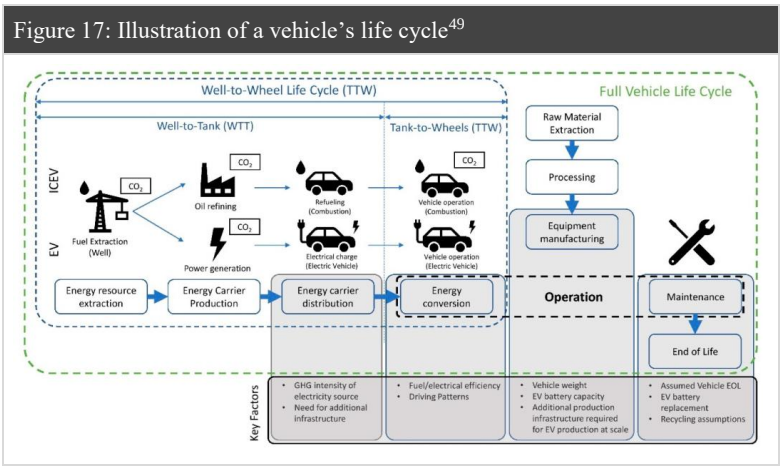
Although ZEVs do not produce tailpipe emissions[46], there is evidence that electric cars have higher GHG emissions at the production stage in comparison to conventional cars. This is mostly associated with battery manufacturing. However, research suggests, when considered over the whole life cycle, ZEVs still turn out to be more environmentally friendly.[47]

This impact can be reduced when we produce batteries with low carbon electricity. This already occurs in countries with clean electricity mixes or in factories that rely mostly on renewables, such as the Tesla Model 3 factory.[48]

A vehicle's life cycle

The following figure presents the lifecycle of a vehicle from conception to disposal.

Figure 17: Illustration of a vehicle's life cycle[49]



[45] https://www.iea.org/reports/global-ev-outlook-2020

[46] https://www.epa.gov/greenvehicles/explaining-electric-plug-hybrid-electric-vehicles

[47] https://www.transportenvironment.org/sites/te/files/downloads/T%26E%E2%80%99s%20EV%20life%20cycle%20analysis%20LCA.pdf

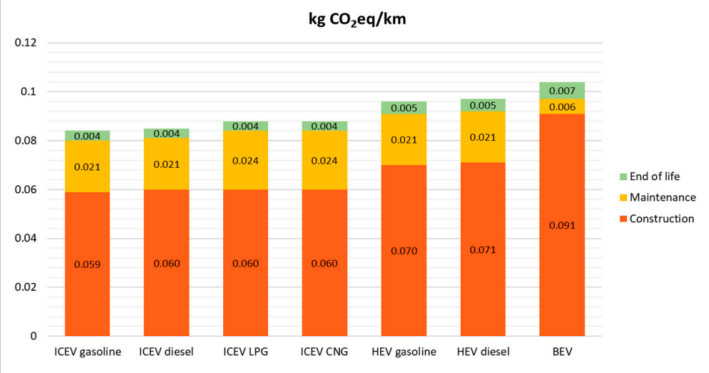
[48] https://www.fastcompany.com/90334858/inside-teslas-100-renewable-design-for-the-gigafactory

[49] https://www.mdpi.com/2071-1050/12/22/9390

The cradle to grave analysis suggests that emissions start from the sourcing (extracting, refining, processing, etc) of materials for its manufacturing, continue during its operation (when the vehicle is on the road), and also stay part of it at the end. It depends on how the vehicle and its parts (including batteries) are disposed of at the end of life.

Research identifies both the difference among GHG emissions at "vehicle level" (Scope 2 & 3 emissions) and at the "mobility system level" (scope 1 emissions).[50] The following figure demonstrates the relative emissions impact of a BEV against other propulsion systems:

Figure 18: Relative CO2 emissions by propulsion type



At vehicle level, BEVs can have 20% higher emissions than ICEs and 6.5% higher than HEVs. However, at the mobility system level (the use phase), the difference is significant in favour of the BEV, and in Europe alone, a 100% BEV scenario can cut lifecycle emissions by 63% over the lifetime usage.

Transport and Environment (T&E), a EU leading clean transport campaign group, concluded in its recent LCA report that electric vehicles produce 3 times less CO_2 emissions when compared to conventional petrol and diesel cars on a lifecycle basis. It also says:

> *"Discussing whether or not coal-fuelled electric cars are better or worse for the climate than conventional cars is no longer relevant (ZEVs are 30% cleaner even then). The urgency should be placed on accelerating the transition to electric mobility while at the same time decarbonising the electricity grid.*

3.1.4 Light vehicle fleet transition

There are 164 light vehicles in the DRC fleet, with 109 utes, 1 hatchback, 8 station wagons, 45 SUVs and a single van. The market supply of light commercial utes and vans is currently particularly limited for zero emissions vehicles in Australia, with only the Renault Kangoo ZE in the market fitting this description.

[50] https://www.mdpi.com/2071-1050/11/16/4328/htm

BYD has publicly stated its intention to release the T3 van. The T3 gained regulatory approval for importation on 30 May 2021 and is said to be coming to market at more than $10,000 less than the competing Renault Kangoo ZE product.

The market does not currently offer a zero emissions alternative in the light commercial utes segment from an established vehicle OEM. Highly engineered examples based on the Toyota Hilux 70-series exist in the market and have been modelled as an alternative to existing utes.

Zero emissions examples of passenger vehicles such as SUVs, hatchbacks, station wagons and sedans are more prolific in the Australian market; however, the local market does not currently receive the full suite of options available in comparable right hand drive markets such as the UK and Japan.

10 year asset replacement analysis results - light vehicle fleet

The table below outlines how the three modelled scenarios are differentiated. A full table of assumptions is provided in Appendix A, Addendum 2.

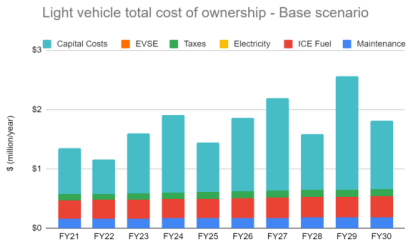
Table 19: Description of modelled scenarios

Scenario name	Scenario description
Business as usual	Under this scenario, all fleet assumptions remain in place, vehicles are replaced directly like-for-like (not selecting an optimised ICE TCO option) and zero emissions vehicles are not procured
ZEF Roadmap	Under this scenario, all fleet assumptions remain in place, total cost of ownership optimisation is introduced, and zero emissions vehicles are procured where a zero emissions vehicle has the best TCO available in the market
ZEF Roadmap optimised	Under this scenario, all fleet assumptions remain in place, save for the extension of asset holding conditions by 1 year and 20,000km for passenger vehicles and light commercial utes. Total cost of ownership optimisation is introduced, and zero emissions vehicles are procured where a zero emissions vehicle has the best TCO available in the market

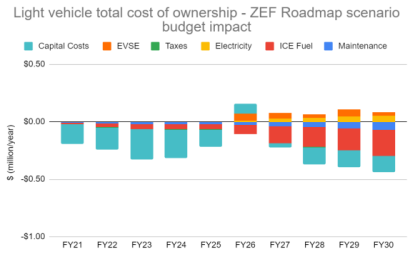
The results of the TCO analysis of the following three scenarios is presented below:

Figure 19: 10 year total cost of ownership and transitions per year

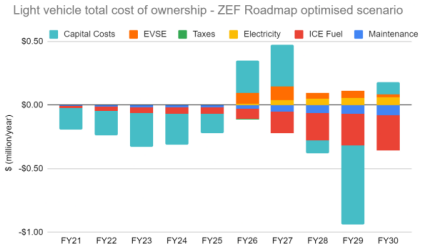
Business as usual scenario



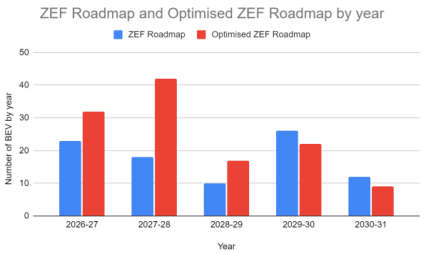
ZEF Roadmap scenario budget impact



Optimised scenario budget impact



Year ZEV replacement TCO beneficial



The following is a replacement budget that reflects meeting the goals of the ZEF Roadmap through the two scenarios listed above, with business as usual presented as a reference. The NPV over the period for each scenario is as below:

Table 20: Scenario NPV and emissions outcomes

Scenario	NPV ($ million)	NPV vs baseline	Emissions (CO2 tonnes)	Emissions vs baseline
Scenario 1 - Business as usual assumptions	$17.46M	+/-0%	8,393	+/-0
Scenario 2 - ZEF Roadmap assumptions	$15.11M	-13.5% - $2.35M	6,739	-19.7%
Scenario 3 - ZEF Roadmap optimised assumptions	$15.35M	-12.1% - $2.11M	6,400	-23.7%

The results of analysis present some unexpected outcomes, including a notable gap between business as usual and the ZEF roadmap. A review of the main drivers of this difference found the following leading causes:

- In the BAU case (scenario 1), flexibility is offered to staff to choose vehicles that best meet their needs. In the ZEF Roadmap scenarios a complex process of optimising vehicle selection is undertaken, selecting the best TCO option from within the FCAI category of the existing vehicle

- In the BAU case, vehicle shortlisting for leaseback focuses on manufacturer rated fuel economy costs and depreciation only, and is based on an assumed 20,000km per year. In the ZEF Roadmap scenarios, actual distance travelled, duty cycle loading (relative energy consumption vs rated), tyres, insurance, maintenance, government costs, accessories and other components are also accounted for.

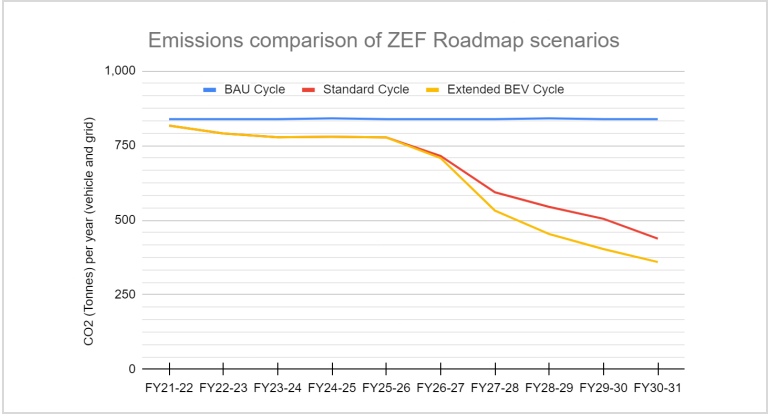
> **Insight:**
> Distance travelled varies from 3,000km to 53,600km with an average of 19,400km. The average distance travelled is a strong driver of variable cost components in fleet asset management and vehicles with better fuel economy and those powered by electricity can offer improved total cost of ownership. Some vehicle use cases with heavier duty cycles and higher annual distance travelled benefit from replacement options with improved fuel consumption, even where the purchase price and depreciation are higher.

Scenario 3 offers an optimisation pathway that models the total cost of ownership of electric utes and passenger vehicles with altered holding period terms including an additional year and 20,000 km to holding period thresholds. The 10-year total cost of ownership results show a slightly higher cost over ten years with the optimisation pathway, which appears counterintuitive, but following investigation is a sensible outcome.

Electric vehicles have a higher upfront purchase price and a lower running cost per kilometre. The total cost of ownership over both 3 or 4 years for electric vehicles only overcomes the higher upfront costs towards the end of the ownership period. As these vehicles are only on average half-way through their holding period at the end of the 10 year reporting period for total cost of ownership, the appearance of a higher total cost of ownership can be observed.

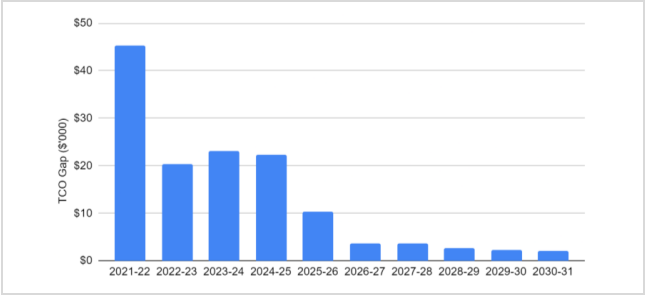
Emissions reduction and fuel savings per kilometre were found through the provided analysis to be typically around 75-80% per asset. Overall carbon emissions are compared in the following figure:

Figure 20: Emissions comparison of ZEF Roadmap scenarios



It can be seen that based on the optimising approach of the ZEF Roadmap scenarios that prior to the introduction of zero emissions vehicles in 2026, a number of the higher fuel consuming traditionally powered assets are moved to more economic options. This comes with a total cost of ownership saving and reduction in emissions of 61 tonnes of CO2 per year.

Figure 21: Average ZEV vs best overall TCO by year



Where the relative TCO to move to a ZEV is small, the assumptions of this analysis require the outcome to present a traditionally powered vehicle. A key takeaway from this analysis is that the lower the TCO gap, the lower the cost per tonne of carbon emissions abated. To facilitate this conversation, Addendum 1 to this report includes a table (Addendum 1, Tables D, E) that presents the total cost of ownership gap at each replacement point where a viable zero emissions vehicle exists or is modelled as existing in the market.

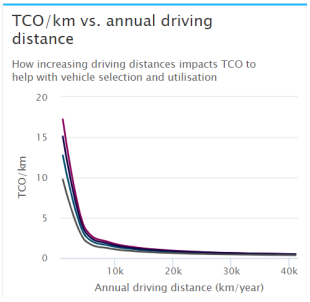
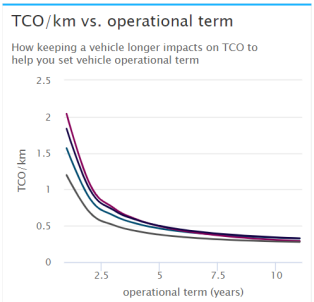
During a period of fleet transition, fleet optimisation opportunities will become more common as the 'rules of the game' are changed. Some examples of fleet optimisation to consider are:

1. Consolidate vehicles with lower daily driving range to increase average annual distance travelled

2. Prioritise the use of fleet ZEVs for short day trips to minimise the cost of travel per kilometre and increase ZEV utilisation
3. Prioritise particular internal combustion vehicles to be used where occasional longer trips occur, lowering the range performance demanded from ZEVs
4. Establish a formal "rule in" baseline requiring ZEV selection, and introduce specific fit-for-purpose attributes that may "rule out" electrification
5. Adjust vehicle holding periods, for example electric vehicles do not require the maintenance of traditionally powered vehicles and so there is strong benefit in extending the holding period of EVs out to 5 or more years

The following tables show how the TCO can be improved by holding vehicles for longer or driving them more each year.

Figure 22: TCO optimisation opportunities

TCO - optimising mileage	TCO - optimising holding period
	

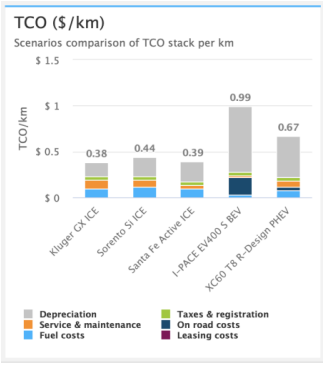
Business as usual short term ZEV options and TCO comparison

The total cost of ownership and emissions outcomes for common-to-fleet asset segments are presented below. This process seeks to assist DRC to identify the best total cost of ownership examples in segments common to the DRC fleet.

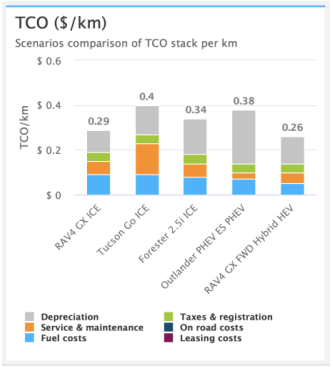
Modelling presented in this section applies the calculated average kilometres for light commercial and for passenger vehicles to represent the TCO of the average vehicle. Modelling has been completed using Evenergi's BetterFleet TCO tool and the assumptions presented in Appendix A, Addendum 2.

Figure 23: Examples of TCO results by FCAI segment

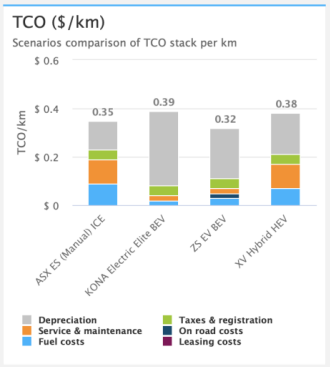
Large SUV TCO examples



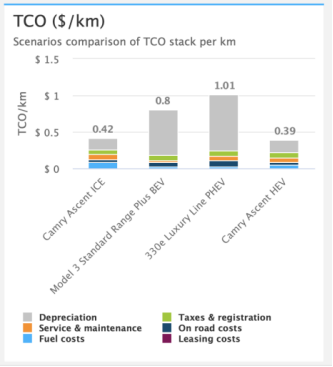
Medium SUV TCO examples



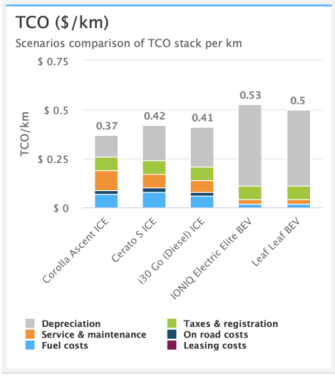
Small SUV TCO examples

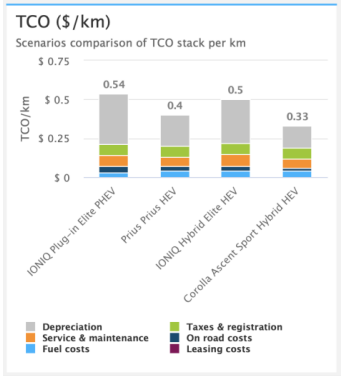


Medium Passenger TCO examples

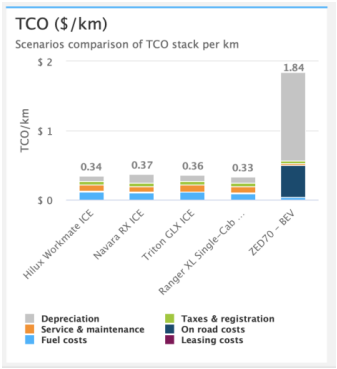


Small Passenger TCO examples

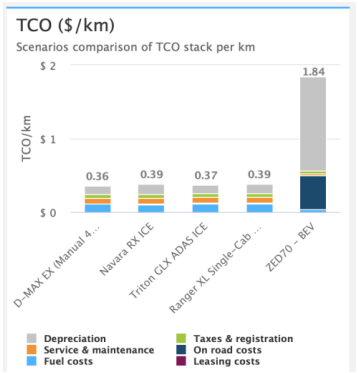




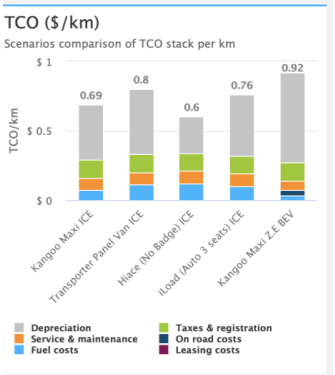
LCV 4x2 Utes TCO examples



LCV 4x4 Utes TCO examples



LCV van TCO examples



Real world light electric vehicle performance considerations

Decisions regarding procurement of electric vehicles must be mindful of the true driving range of such vehicles. The table below is provided to support decision making, and shows the impact of various extreme driving duties on real-life expected range, as well as the worst-case range (operating below zero-degrees with heavy use of heating).

Table 21: Light EV performance under various driving conditions

Electric Vehicle	WLTP Rated Range (km)	Real Range (km)	City Range (km)	Highway Range (km)	Worst Case Range (km)
Hyundai Ioniq	311	266	293	233	158
Hyundai Kona	484	414	457	362	245
MG ZS EV	262	225	248	197	134
Nissan Leaf	270	231	255	202	137
Renault Kangoo	214	183	202	160	109
Tesla Model 3	415	355	392	311	211
Zero ZED70	300	257	283	225	152

Real world range was found to be appropriate for the vast majority of trips taken by vehicles in the DRC fleet. As the recommended date of introduction for zero emissions vehicles is beyond 2025 from a TCO perspective, it is noteworthy that as battery price and density improves by around 10% per year, driving range is likely to increase by a significant margin by that date.

Trigger points for TCO parity by light vehicle segment

An analysis of the point of TCO parity between traditionally powered vehicles and zero emissions vehicles across each scenario was undertaken. The results are presented in the table below.

Table 22: Segment parity procurement trigger points

Segment	Target price Standard scenario	Target price Optimised scenario
Medium SUV	$41,300	$41,300
Large SUV	$60,300	$78,500
Utes	$46,800	$51,600
Van	$28,600	$28,600
Small Passenger	-	$25,900

FBT considerations in a light vehicle fleet transition

There are currently no differences in how an EV is treated from an ICE vehicle with regards to FBT. Political parties are making some promises about changing this. The Australian Labor Party, for example, is proposing a policy which will apply to electric cars priced below the luxury car tax threshold for fuel-efficient vehicles ($79,659 in 2021-22). EVs will be exempt from the 5% import tax and from FBT for cars provided through work for private use.

The FBT impacts of selecting an EV can be summarised as follows:

- Generally, all current EVs are passenger vehicles and therefore not able to be exempt from FBT.
- The Statutory Method of calculating FBT is based on the value of the car, including "the base value of the car, which is the original price paid (excluding registration and stamp duty), the cost of any fitted non-business accessories, and dealer delivery charges with all cost and charges including GST and luxury car tax where appropriate". The luxury car tax threshold is $79,659 for 2021-22, which will impact some EVs.
- The Operating Cost method includes lease costs which may be higher for EVs and deemed costs such as depreciation if the vehicle is owned, which also may be higher for EVs.
- There are indications that commercial EVs will be available soon (utilities and vans). These would then fall under the FBT exemptions outlined above unless further policy changes were made specifically around FBT and commercial vehicles.

FBT impact of vehicle changes

In some cases, an analysis of vehicle usage will identify that an FBT-exempt vehicle can be replaced by an EV. For example, a supervisor driving a utility may no longer require the functionality of a Ute but still need a vehicle. In such cases, unless the driver satisfies the itinerant worker requirements (which are not easy to meet), there will be an FBT cost to the organisation.

3.1.5 Heavy vehicles fleet transition

10 year asset replacement analysis results - heavy vehicle fleet

The table below outlines how the three modelled scenarios are differentiated. A full table of assumptions is provided in Appendix A, Addendum 2.

Table 23: Description of modelled scenarios

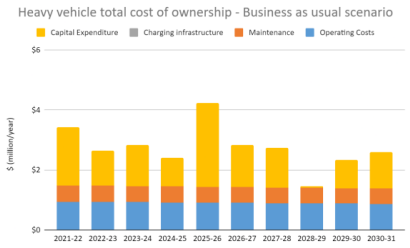
Scenario name	Scenario description
Business as usual	Under this scenario, all fleet assumptions remain in place, vehicles are replaced directly like-for-like (not selecting an optimised ICE TCO option) and zero emissions vehicles are not procured

ZEF Roadmap	Under this scenario, all fleet assumptions remain in place, total cost of ownership optimisation is introduced, and zero emissions vehicles are procured where a zero emissions vehicle has the best TCO available in the market and where technically viable
ZEF Roadmap optimised	Under this scenario, all fleet assumptions remain in place, save for the extension of asset holding conditions by 3 years to 10 years. Total cost of ownership optimisation is introduced, and zero emissions vehicles are procured where a zero emissions vehicle has the best TCO available in the market and where technically viable

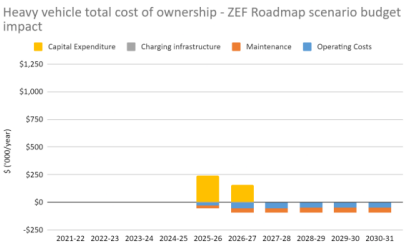
The results of the TCO analysis of the following three scenarios is presented below:

Figure 24: 10 year total cost of ownership and year of transition

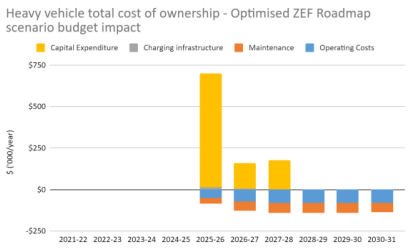
Business as usual scenario



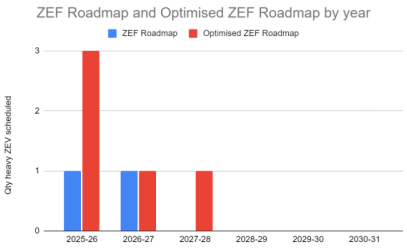
ZEF Roadmap scenario budget impact



Optimised scenario budget impact



Year ZEV replacement TCO beneficial



The following is a replacement budget that reflects meeting the goals of the ZEF Roadmap through the two scenarios listed above, with business as usual presented as a reference. The NPV over the period for each scenario is as below:

Table 24: Scenario NPV and emissions outcomes				
Scenario	NPV ($ million)	NPV vs baseline	Emissions (CO2 tonnes)	Emissions vs baseline
Scenario 1 - Business as usual assumptions	$27.48M	+/-0%	10,972	+/-0
Scenario 2 - ZEF Roadmap assumptions	$27.36M	- 0.44% - $0.12M	10,866	-1.0%
Scenario 3 - ZEF Roadmap optimised assumptions	$27.74M	+ 0.95% + $0.26M	10,828	-1.3%

The most accelerated electrification of the DRC heavy truck fleet contemplated focused on extending the holding period of heavy electric vehicles to 10 years. For the scenario, an overall increase in fleet costs of up to $264,000 is expected over the fully realised asset cycles contemplated over the 10 year fleet transition plan 2021 - 2030. For the standard ZEF pathway, an expected saving relative to business as usual costs is predicted in the order of $117,000.

These increases over the 10 years relate to the increased upfront cost of the vehicles. The reduced operating costs more than recover the additional upfront costs, but the recovery period extends beyond the 10-year budget presented.

While there are a number of technology questions remaining unanswered, as ZEF technology improves over time, it is recommended that actions are taken to gain insights by pulling forward electrification opportunities in pilot form.

Technical suitability of heavy vehicles

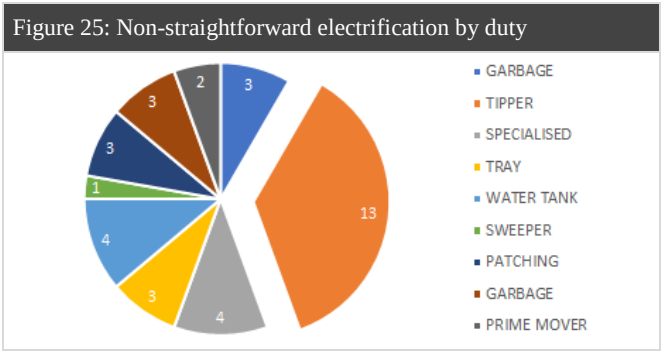
The like-for-like replacement analysis for the DRC heavy vehicle fleet considers the function, weight, daily energy requirements and daily driving range of the current fleet. These details are matched against the specification and lived experience of potential suitable electric vehicle replacements to map potentially suitable replacement options.

The analysis considers implementations to be operationally straightforward (requiring no day time charging) or operationally not straightforward (requiring a level of day time charging). It was found that while the average daily duties of all vehicles in the fleet were found to be technically viable with current technology, only 38 of 72 (53%) of the heavy fleet have an operationally straightforward electric option available currently on the market.

Of the vehicles with a straightforward replacement option, only one was found to offer a positive TCO over the ten year forecast for the ZEF Roadmap scenario, and six under the optimised ZEF Roadmap scenario. It is noteworthy that 7 of the 38 operationally straightforward replacement options are met by a vehicle specification proposed by this analysis to be available at the scheduled replacement date, but not currently available in the market.

There was a diverse range of duties within the DRC fleet that were found to be not operationally straightforward, as follows:

Figure 25: Non-straightforward electrification by duty



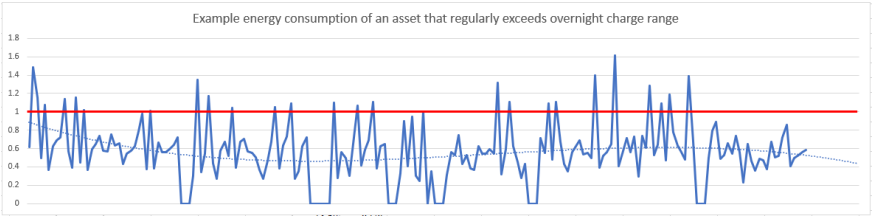
The larger proportion of tipper trucks in the graph above is by virtue of there being a significant number of tipper trucks in the heavy vehicle fleet. Those tipper trucks with non-straightforward electrification are broadly the larger tippers with GVM over 16 tonnes.

Operational performance is prioritised under this analysis, ensuring that all typical and extreme-case use scenarios are accounted for. This means vehicle performance is modelled under the most energy intensive winter days and intense annual duties.

A key insight into the analysis of heavy vehicles with very intensive worst-case energy usage occurred in very rare cases, and the typical energy use is in all cases within that provided by a single overnight charge, even accounting for vehicle battery conduction at point of disposal.

An asset's annual energy consumption can be used to describe the benefits of better understanding the behaviour of fleet energy consumption. A real example of daily energy consumption is presented below as a proportion of the worst-case energy consumption of a heavy green waste side-loader, with the dotted trendline showing seasonal variation across the year.

Figure 26: Example of energy variation over a full-year cycle



Note: Results normalised such that 1 equals full daily energy capacity of the vehicle after 10 years of operation

For instances where there is no like-for-like ZEV replacement capable of meeting operational requirements without recharging, a recommendation for like-for-like replacement has been made regardless, based on payload/GVM, and is presented in Appendix 5, Addendum 1 alongside the energy shortfall. This will assist DRC to understand which assets currently require additional consideration of mid-shift recharging. The year that each asset becomes TCO beneficial to move to a ZEV option is presented in Appendix 4, Addendum 1.

> **Myth Buster**
> Electrification of heavy vehicles is not a discussion between economics on one side and the environment on the other. Electrification often means strong economic benefits alongside environmental benefits, as well as health and wellbeing benefits for operators.

Targeted pilot program design

A targeted pilot program for heavy vehicles should include:

1. Testing of short bursts of opportunistic fast-charging at the depot during a shift, and the impact on demand for chargers and operational efficiency
2. Testing the impact of additional vehicle weight on maximum payload and how that manifests operationally
3. How to plan effectively for and mitigate situations where an unexpected shortage of battery capacity occurs
4. Accurate instantaneous weight and energy consumption in order to accurately plot drivers of vehicle performance and optimise energy consumption. It is recommended to extend the average holding period to 10 years to improve the total cost of ownership outcomes for heavy electric vehicles, taking advantage of the benefit of a simplified drive-train with less moving parts and maintenance needs.

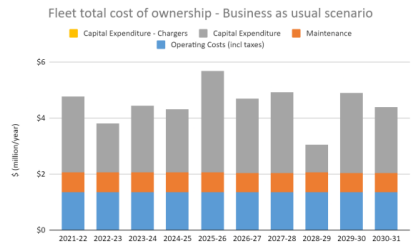
A pilot project to embed electrification of heavy vehicle assets might seek to target vehicle Water and Sewage ISUZU NPR400, vehicle ID 468. This vehicle is a marginal technically suitable asset on worst-case scenario analysis, yet on a typical day would return to base with around 80% charge remaining. The overall additional cost over 10 years for this vehicle is around $120,000 including charging infrastructure.

3.1.6 Full fleet 10 year asset replacement analysis results

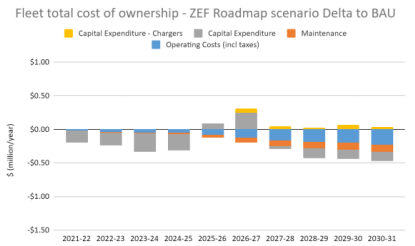
The results of the TCO analysis of the three analysed scenarios are presented below:

Figure 27: 10 year total cost of ownership and year of transition

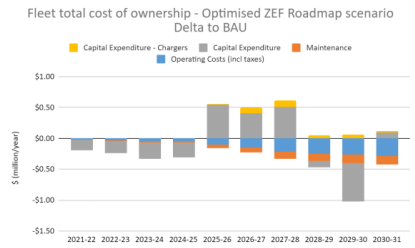
Business as usual scenario



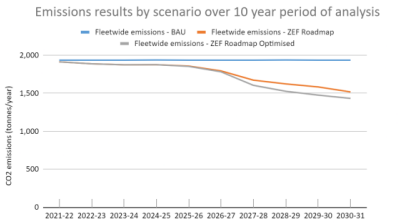
ZEF Roadmap scenario budget impact



Optimised scenario budget impact



Emissions results by scenario



The following is a replacement budget that reflects meeting the goals of the ZEF Roadmap through the two scenarios listed above, with business as usual presented as a reference. The NPV over the period for each scenario is as below:

Table 25: Scenario NPV and emissions outcomes

Scenario	NPV ($ million)	NPV vs baseline	Emissions (CO2 tonnes)	Emissions vs baseline
Scenario 1 - Business as usual assumptions	$44.94M	+/-0%	19,365	+/-0
Scenario 2 - ZEF Roadmap assumptions	$42.47M	- 5.50% - $2.47M	17,605	-9.0%
Scenario 3 - ZEF Roadmap optimised assumptions	$43.10M	- 4.09% - $1.84M	17,227	-11.1%

3.2 Vehicle Management

3.2.1 Financial analysis of in-house servicing vs dealer servicing

Maintenance on modern electric vehicles

The low complexity of electric vehicles results in only a small number of moving parts throughout the entire vehicle. In the powertrain this is represented by the stator/rotor, which is zero contact and does not wear out in a meaningful way, and the motor bearings. Cooling circuits are largely sealed or lubricated for life, with software updates, brake fluid, wiper fluid, wiper blades, tyre and wheel alignment and care, air conditioning servicing and the cabin air filter being the only maintenance items typically requiring attention.

Major service issues such as motor bearing failure and battery degradation are not issues that arise in the operational life of electric vehicles, though are known to occur on occasion and are warranty covered items. Given the recent introduction of these technologies to fleets, vehicle manufacturers often offer extended warranty on these components for peace of mind.

Scope limitations for in-house maintenance

Maintenance issues in modern electric vehicles arise predominantly from failures of sensors, which manifest most often as error codes in a vehicle, but can also set off events that limit the operation of a vehicle (e.g. limp home mode). Decoding of errors can be accomplished using specialist equipment; however, rectification of failure codes to extinguish dashboard warnings requires access to special IP owned by the vehicle manufacturer. This limitation of access further pertains to software updates (in the case of most manufacturers, although there is a trend towards over-the-air updates), some of which are required to maintain a valid warranty.

Manufacturers of ZEVs currently in the market contacted by Evenergi consistently relayed that the service department of their dealership partners is a critical income stream supporting the operation of those businesses. Those contacted report that there is no interest from respective international headquarters to entertain the release of specialist hardware or training to organisations outside of partnering dealerships.

External maintenance costs

Servicing costs for zero emissions vehicles are one of the key differentiators in cost of ownership. The below table presents an example of the Hyundai Kona which can be purchased as either a traditionally powered option or electric option.

Table 26: Comparison of external servicing costs - ICE vs ZEV

General service	ICE powered example	ZEV example
First 3 years*	$548	$330
First 60,000km*	$1,156	$660

Servicing in the above case covers the following minor checks:

- Carry out complete global diagnostic system (GDS) check
- Check operation of instrument warning lights, gauges & illumination
- Check vehicle for outstanding recalls or service campaigns
- Inspect air conditioner refrigerant/compressor
- Inspect 12V auxiliary battery
- Inspect chassis, hoses, lines, connections, brake pads, seat-belts, linkages, tyres

It is significant that none of the maintenance schedules for a zero emissions vehicle relate specifically to the high voltage drivetrain, such as the battery, inverter, onboard chargers or traction motors. These items are sealed and designed to last the life of the vehicle.

The cost of service and maintenance claimed by other vehicle OEMs has not yet settled on a standard approach. The majority of vehicle OEMs maintain a scheduled servicing arrangement - with Nissan being a notable example[51] - but charge a lower amount to service electric vehicles. Tesla does not recommend scheduled maintenance, but rather informs the user of the key timing between replacing filters (2-3 years), rotating and balancing tyres, testing brake fluid (2 years) and servicing the air conditioning system (every 6 years for Model 3).

Evenergi has spoken to the local dealers able to offer new vehicle sales and service support for electric vehicles, and notes that much progress has been made on the front in recent years. The local Nissan and Kia dealers have installed equipment and trained staff in readiness for electric vehicles sales, while the local Hyundai dealer is in the process of mapping the path to a similar level of service readiness and claims to be ready to provide support. Hyundai offers a financial assistance program to its dealerships to help them upgrade their infrastructure and facilities to enable electric vehicle maintenance and repairs. This offer of Hyundai HQ to subsidise the upgrade of service centres (~$80,000 full cost) has been extended to Hyundai (Sainsbury) in Dubbo.

In-house vs outsourcing zero emissions vehicle maintenance

ZEVs typically operate at much higher voltages than other battery-powered industrial equipment. As such they can create several unique hazards, and it is prudent to consider these hazards in the process of determining whether electrified vehicle solutions meet the needs of fleet managers.

SafeWork NSW[52] identified stored or generated electrical energy, battery electrolyte and powerful magnets housed within electrical motors as potential new workplace hazards associated with electrified vehicles. SafeWork NSW considers a number of key areas of focus necessary to ensure a safe working environment for those engaging with electric vehicle maintenance. Details of the recommended approach can be found in Appendix I, Addendum 2.

[51] www.nissan.com.au/content/dam/Nissan/AU/Files/Owners/Servicing/capped-price-service/Capped%20Price%20Service%20-%20LEAF.pdf
*Skipping final service at disposal
[52] https://www.safework.nsw.gov.au/hazards-a-z/electric-vehicles

Cost comparison - internal vs external servicing and maintenance costs

The following table presents the approximate relative cost of scheduled maintenance for internally vs externally completed servicing. The very low level of work being completed at such service intervals in an electric vehicle is estimated to be a real world 45 minutes including documentation.

Table 27: Comparison of internal vs external EV servicing and maintenance costs

General service	ZEV internal servicing	ZEV external servicing
First 3 years*	$138 at $92/hr	$330 at approx $440/hr**
First 60,000km*	$138 at $92/hr	$330 at approx $440/hr**

* Shows cost whether meets age (per 12 months) or mileage (per 20,000km) triggers
** Real time to perform duties ~ 0.75hr (noting significantly reduced scope relative to ICE vehicle servicing)

The relative cost of internally servicing an electric vehicle is therefore estimated at around a 79% saving over external servicing, and given the nature of the work would not require special high voltage servicing capability.

3.2.2 Operational impacts of adopting ZEVs

The operational impacts of electric vehicles fall into two main categories:

1. Changes required to facilitate vehicles with lower range; and
2. Changes required to facilitate charging.

The degree to which operations changes are implemented to deal with the limited range of ZEVs depends on:

1. The degree to which existing ZEV substitutes are able to meet the duty task of the fleet; and
2. The willingness of an organisation to change operational procedures to optimise around transitioning to a zero emissions fleet.

If an organisation is looking to accelerate the adoption of a ZEV fleet, then they will either look at options such as Hydrogen which can meet the duty task of most fleet vehicles, or will look to maximise the adoption of battery electric vehicles wherever there is a duty cycle that can be met by the vehicle. Once all vehicles (or runs) that can be easily met by battery electric vehicles are transitioned, the optimisation of those requiring longer ranges can be managed via more granular assessments of peak range requirements, and either splitting tasks, or having a pooled standby vehicle able to absorb complex tasks if required.

The impacts of charging infrastructure is covered below, but in general there are considerations of the processes around ensuring people remember to plug in, the safety and OH&S training and considerations and any back-office billing requirements to take into consideration.

3.2.3 Impacts of extreme heat and cold on electric vehicle batteries

Dubbo's temperature profile

Dubbo's climate is classified as warm and temperate with a tendency for frequent droughts. Average temperatures range from around 26 °C to around 9.4 °C.[53] Dubbo weather data from 1993 shows that the most recent few years have been associated with the most extreme temperatures.

Table 28: Top three extreme temperatures recorded at Dubbo airport

Position	Daily maximum temperature, month and year	Daily minimum temperature, year
1	45.0°C, January 2020	-6°C, July 2018
2	46.1°C, February 2017	-4.9°C, June 2017 and 2002
3	44.9°C, December 2019	-4°C, May 2017

A full list of lowest monthly recorded temperatures at Dubbo weather station since its installation in 1993 is demonstrated below.

Figure 28: Upper and lower bound monthly temperature profiles[54] [55] [56]

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	33.6	32.0	29.1	24.9	20.1	16.4	15.6	17.5	21.4	25.2	28.9	31.6
Highest monthly mean	39.0	36.4	32.6	29.1	21.5	18.4	18.0	20.1	24.2	29.9	34.1	35.8
Lowest monthly mean	28.8	28.1	26.2	21.0	17.9	14.0	13.3	14.9	18.1	21.1	23.7	27.1
Highest Daily	45.0	46.1	39.5	34.4	28.6	24.1	23.1	28.3	35.5	38.1	44.3	44.9
Lowest Daily	20.1	18.5	18.1	10.4	8.5	7.7	7.8	8.6	11.3	12.6	14.2	18.3

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	18.4	17.7	14.8	10.4	6.5	4.4	3.0	3.1	6.1	9.5	13.5	16.0
Highest monthly mean	23.0	19.6	17.2	13.4	9.7	6.7	5.7	6.3	8.7	13.0	17.9	17.9
Lowest monthly mean	14.2	14.5	11.7	6.9	2.8	2.3	0.1	1.2	3.6	7.0	10.1	13.7
Highest Daily	28.6	31.6	23.8	20.2	17.2	14.6	14.0	15.3	20.1	22.4	27.1	28.1
Lowest Daily	5.8	6.3	3.4	-2.2	-4.0	-4.9	-6.0	-4.9	-3.2	-0.4	2.0	4.5

Dubbo's temperature demonstrates a significant temperature range throughout the year, which requires exploring how these extremities impact battery performance and any ramifications on the electrification of the current fleet. Understanding the worst case temperature scenarios enables fleet managers to be confident that their low emissions vehicles will be safe and range-capable in extreme temperatures.

[53] https://en.climate-data.org/oceania/australia/new-south-wales/dubbo-1302/

[54] www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=122&p_display_type=dailyDataFile&p_startYear=&p_c=&p_stn_num=065070

[55] www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=123&p_display_type=dailyDataFile&p_startYear=&p_c=&p_stn_num=065070

[56] At Dubbo Airport

The impact of extreme ambient air temperatures

Studies reveal that temperatures have a significant impact on battery performance and EV specific range[57]. An EV's officially listed range simply acts as a guideline, as actual range values depend on real-life conditions such as load, terrain, speed and ambient air temperatures.

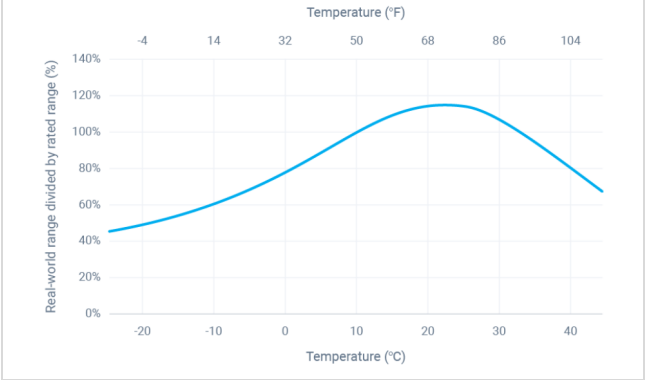
ZEVs typically utilise lithium-ion (Li-ion) batteries, and there are many different Li-ion chemistries. A battery's chemical composition dictates how it responds to stress such as extreme temperature conditions. A thorough testing regime conducted by the American Automobile Association (AAA) demonstrated how a range of temperatures impact vehicle range and the implications on battery performance at a low temperature of ~ -7°C, mid temperature of ~ 24°C and a high temperature of ~ 35°C.

At the low temperature, the energy consumption relative to testing at the mid temperature was from 6 - 13% across tested vehicles and driving conditions. At the other extreme temperature of 35°C, the energy consumption relative to testing at the mid temperature was from 2 - 4% across tested vehicles and driving conditions.

Insight: Understanding the impact of extreme climates will enable ZEV drivers to navigate unexpected reductions in driving range.

To further support this study, the global leader in Internet of Things (IoT) and connected vehicles, Geotab, has analysed real-life data from thousands of ZEVs representing 102 different make/model/year combinations and revealed consistent findings. The data shows that the average vehicle range peaks at 21.5°C at around 115% of quoted range and diminishes above and below that temperature across all vehicle models.

Figure 29: Impact of temperature on vehicle range[58]



[57] https://www.geotab.com/blog/ev-battery-health/

[58] https://www.geotab.com/blog/ev-range/

The further above or below the temperature to the optimal 21.5°C, the more range is lost. At -15°C (5 °F), ZEVs drop to 54% of their rated range, meaning a car that is rated for 402 km will only travel on average 217 km[59]. It is noteworthy that Geotab data is real-world data from predominantly across Europe, with driving conditions reflecting those in European countries.

Insight: Battery sizes have increased with the introduction of new EV models in order to meet trip needs. Despite this, accepting that vehicles lose range with extreme temperatures and understanding the daily distance needs of vehicles will enable DRC to implement the most suitable fleet replacement vehicle for specific needs.

The impact of ancillary heating and cooling systems

As discussed above, batteries are particularly sensitive to temperatures and this can further be dissected into the ambient air temperature and interior temperature. The interior of a vehicle can be controlled using ancillary systems, which are defined as heating, ventilation, and air conditioning (HVAC) systems.

The same research study conducted by AAA as summarised above seeks to determine the impact of HVAC on the driving range of the same vehicles at low, mid and high temperatures. In the experiment, the HVAC system was placed in "Auto" mode with a thermally comfortable set point of 22.22°C.

At the low temperature with heating applied, the energy consumption relative to testing at the mid temperature was from 20 - 46% across tested vehicles and driving conditions. At the other high temperature point with air-conditioning applied, the energy consumption relative to testing at the mid temperature was from 7 - 21% across tested vehicles and driving conditions. The energy draw is substantial when operating HVAC systems and heating or cooling a vehicle from a very high or low set point. While this is mitigated generally by parking a vehicle under cover and avoiding extreme cabin temperatures, it is certainly a factor to consider.

Insight: The total amount of onboard energy in a ZEV is significantly less than in an ICE vehicle, and ZEVs are significantly more efficient. By way of example, a 57 litre fuel tank holds the equivalent of 505.5 kWh of energy, which is more than six times what the highest spec Tesla Model 3 can carry. A Toyota Kluger will travel around 600km on this quantity of fuel, while the same Tesla Model 3 will cover around 650km. Vehicle loads like air conditioning have a larger impact on ZEVs because of their much lower onboard energy capacity.

For DRC, replacement of an asset with a ZEF alternative would introduce a new operational risk requiring training to assist drivers in understanding their specific vehicle needs and how they differ from traditional vehicles, including any changes in driver behaviours. This may include heating or cooling the vehicle amenities such as the dashboards or seats, rather than the air; or warming or cooling a vehicle while it is still plugged in to minimise the auxiliary load before it starts its journey.

[59] https://www.geotab.com/blog/ev-range/

3.2.4 Specific training required for drivers of electric vehicles

Driver behaviour is one of the most significant factors leading to unforeseen costs such as collision damage, unfair wear and tear and poor fuel economy[60]. Most driving skills are interchangeable between driving ICE and electric vehicles. However, there are some key differences in the operation and driving styles between the two and a driver who initially enters an EV from an ICE vehicle may not realise the full value of the vehicle. As such, an effective way to reduce fleet costs and maximise vehicle performance is by identifying specific areas of driver capability training, like understanding new vehicle features, performance, safety and technology. Emerging research demonstrates that ZEV driver training can create cost efficiencies through a reduction in energy use and range. One example is the UK's Energy Saving Trust's Ecodriving in EVs program, where drivers showed a 16% reduction in energy consumed and a 20% increase in range after a three-month training period[61].

The different nuances between ICE and ZEVs pose new safety implications so it is vital that training modules include a practical component. This will provide real-life experience to trainees and allow them to practice ZEV operating skills using real ZEVs and equipment such as chargers, rather than simply reading text instructions. Lists of non-exhaustive training topics required for ZEV drivers have been mapped out under various headings below.

Technical differences between ICE and electric vehicles

It is important to provide new ZEV drivers with background information, as this defines the new context they find themselves in. Emphasising the opportunities that are associated with driving ZEVs will engage staff so they buy into the overall vision of what DRC and the fleet team are trying to achieve, which will set them up for success in confidently driving, operating and maintaining EVs.

Table 29: Examples of training in the operation of ZEF vehicles

ZEV training need	Description
An overview of ZEVs	A snapshot of what ZEVs are, when they are coming and the opportunities for fleets and individual users.
Definitions and terminology	New ZEV types require the familiarisation of specific terminology, e.g. units of electricity instead of litres of petrol, charge rate and range, alternating and direct currents.
Differences between ZEV and ICE	To confidently drive an EV, it is key to understand the technical differences between ICE and EVs and how it will impact the driver experience. For example, as opposed to five or six-speed manual and automatic transmissions, most EVs operate only in one-speed settings. As a result, EV users can adjust the amount of power available when accelerating by utilising different driving modes.

[60] https://www.iamcommercial.co.uk/why-train/

[61] https://www.fleetnews.co.uk/fleet-management/driver-training/get-more-out-of-electric-vehicles-with-targeted-driver-training

Understanding the end-to-end process of operating a ZEV	From a user perspective, understanding the end-to-end cycle of operating a ZEV and knowing how it differs from a conventional ICE model is important. This begins with purchasing the vehicle, learning how to operate it on a daily basis, preventative maintenance requirements and end-of-life considerations. It is important that fleet specific dynamics are accounted for, e.g. DRC's fleet policy that outlines leasing arrangements, maintenance requirements and the home charging arrangements.
Charging an EV	Understanding how charging infrastructure replaces petrol stations and the different types of chargers and plug types. How to connect, disconnect to a charge point and general charging etiquette will need to be covered in the training content, as well as methods of finding charging locations. Other considerations include payment, billing and reimbursement methods specific to the fleet.

ZEV driving techniques

As there are differences between the workings of an ICE and ZEV, this will impact the driving experience. Most driving techniques are interchangeable between ICE and ZEVs, but will require minor adjustments to ensure safe handling of the vehicle; these are listed below.

Table 30: Examples of training required on new ZEV driving techniques

ZEV training need	Description
Safe driving techniques	Modern day business relies on real-time interaction, which often causes distractions through phones, new vehicle technology and time pressures, which increase the risks for drivers and other road users. Training modules should include compliance of road rules and new techniques on how to operate a ZEV. Unlike ICE models, EVs feature regenerative braking, sending energy back to the battery whenever braking. Braking and decelerating an EV occurs substantially quicker than with an ICE vehicle and drivers need to be mindful that the traffic following them may not expect such rapid deceleration, which heightens the risk of a collision. Other techniques include the early release of the accelerator and becoming familiar with the quicker acceleration due to the EV's instantaneous torque. Safe driving techniques should incorporate a real-life driving practice scenario.
Awareness of other road users	A major difference between ICE and electric vehicles lies in the engine noise. An EV exerts relatively faint whirring and tyre noises, which can often be unheard by pedestrians and can raise the risk of an accident. Drivers must be taught to be more cautious and assume that other drivers and pedestrians are unaware of their presence when not looking in their direction.

Vehicle performance controls	ZEVs tend to have quite sophisticated onboard computers that monitor and display energy consumption, efficiency indicators, charge rate and range data and how it links to fleet management information systems. Vehicles also feature numerous driving modes such as the eco setting, which limits power for maximum energy economy. It would be beneficial to understand how to utilise these based on environmental factors, such as extreme weather conditions.

Maximising range and efficiency

A report by Nielsen identifies range anxiety as an area where education is needed in the uptake of EVs, with half of those surveyed saying they believe electric cars can only drive 100-300km at a time.[62] Accordingly, educating drivers on how to maximise range and efficiency can minimise range anxiety.

Table 31: Examples of training required for ZEV optimisation

ZEV training need	Description
Speed awareness	High speeds increase energy consumption in EVs more than they increase in conventional ICE vehicles so when driven aggressively, ULEV range falls significantly. As driving style has a direct impact on battery depletion, ZEV users need to learn how to accelerate smoothly and not to brake suddenly, as this method of driving protects against energy loss. Particular attention should be given to the individual understanding their unique vehicle specifications as this will determine maximum ranges and charging requirements.
Maximising battery range	Understanding what factors degrade a battery life and how to maximise its cycles is a key lever optimising driving range. This includes ideal states of charge, heating and cooling impacts, tyre pressure and how to maximise regenerative braking. Importance should be placed on the available tracking tools and example scenarios, e.g. how to set battery levels when the user is on holiday and does not use the vehicle for a longer period of time, or how stop-and-go city driving impacts a battery differently to highway driving.
Forward planning and observation	Tips and tricks on how to plan a long journey necessitates additional planning to ensure the distance traveled does not exceed vehicle capacity, and how to ensure that there are charging stations along the route, if necessary.

As ZEVs become more prevalent, it can be expected that there will be an increase in training programs. One such example is through the NRMA, who is currently in the process of establishing an EV driving school program. The purpose of this is to educate individuals on basic EV skills, discover the differences between an EV and a petrol vehicle, and drive safely and confidently.

[62] https://www.nielsen.com/au/en/insights/article/2019/caught-in-the-slow-lane/

SECTION 04:

INFRASTRUCTURE

4.1 Infrastructure Procurement

4.1.1 Charging Infrastructure Overview

The aim of this section is to provide DRC with an understanding of what will be required in terms of charging infrastructure at the identified key sites and provide the supporting information to help DRC make the best decisions when procuring suppliers. An infrastructure cost guide is presented in Appendix D, Addendum 2.

4.1.2 Methodology

Deciding on the right charging infrastructure is a balance between:

1. Ensuring that the solution chosen delivers on the operational requirements of DRC. Meeting the operational requirements means understanding where and when vehicles will be charging and the practical requirements that charging hardware and software will need to fulfil.
2. Minimisation of charging infrastructure costs. Managing the cost means optimising the size and number of chargers, and controlling the impacts of charging on energy infrastructure and energy costs.

The process we have gone through to outline the charging requirements for DRC is:

1. A fleet analysis enabled us to create a list of the timing of future electric vehicle replacements in each location according to the two scenarios selected and agreed assumptions
2. Vehicle garaging locations and durations for day and night were ascertained from data provided by DRC, identifying the most appropriate location for vehicle charging
3. The quantity and size of required infrastructure was determined from available charging periods, along with an understanding of the demand for charging at homes
4. Capital expenditure estimates were developed based on identified electrification schedules
5. Maximum demand was modelled from predicted charging profiles on the basis of unconstrained (i.e. all chargers operating simultaneously) and diversified (taking into account the actual likely coincidence of charging sessions) charging profiles
6. Additional scenarios based on better managing demand and optimising deployment of charging infrastructure were considered

4.1.3 Charging hardware

An important decision for DRC will be hardware selection. There are a number of considerations when selecting a system and provider.

We refer to the various ways in which charging systems are designed to provide specific performance as ‘charging typologies’, with examples of these provided in the table below.

Table 32: Examples of charger applications

Charger application	Vehicle duty	Power	Charging Typology
Scheduled /Dedicated	Vehicles doing routine trips, known location and availability for charging, relatively stable charging demands	< 22 kW AC	
Opportunity	Vehicles with irregular trips, or short dwell times.	> 25 kW DC	
Home	Staff who have access to a home charger may not need to use a site charging system.	3.5 kW AC	

Appendix D *Infrastructure cost guide*, Addendum 2 provides further information on cost considerations of each type of charging technology.

> **Insight: SEA Electric heavy vehicle charging**
> While this is described as 'unconstrained', in reality the SEA Electric vehicles come installed with a 22 kW AC charger, which this model represents as being constrained to the minimum possible setting of 11 kW for vehicles that require less than half of the maximum charging rate (at the advice of SEA Electric).
>
> SEA Electric vehicles may be ordered with dual 22 kW AC onboard chargers (44 kW AC) or the capacity to accept DC charging at rates over 50 kW. SEA Electric vehicles are provided standard with a single 22 kW AC charger. Of note about this is that a commonplace 5-pin 3-phase commercial power outlet is required for charging these vehicles, rather than a standalone charger. This simplifies and minimises installation cost and complexity.

4.1.4 Optimising infrastructure investment

There are two key areas in which infrastructure investments can be optimised, futureproofing and optimisation. These are explained below.

Selecting the right charging infrastructure

The key criteria for determining charging infrastructure is to determine the number of vehicles that can charge over a given period and the number that will require fast daytime charging due to their duty cycles.

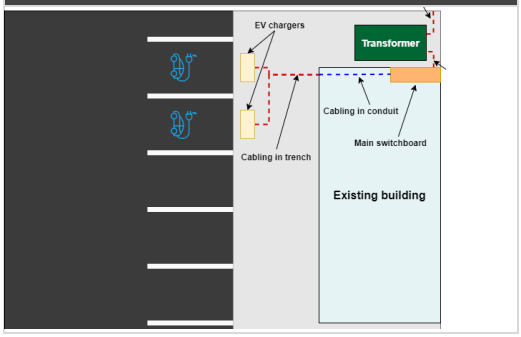
An analysis of the business as usual ZEF Roadmap was undertaken where electric vehicles are adopted in the case where the fit for purpose and the total cost of ownership outcomes align in support of zero emissions options. The following table presents the results of the number of chargers required to be installed under the worst case scenario assumption of 1:1 installation of chargers. This assumption is recommended in the early years of the ZEF Roadmap until it has been operationally demonstrated that this number of chargers is not required.

Futureproofing

The biggest variability in charging infrastructure installations comes from retrofitting and the related complexities around installing or upgrading around existing conditions. Future proofing is therefore one of the key areas where optimisation can be achieved.

For example, trenching and civil works for outdoor car parks can be expensive and subject to unexpected costs due latent conditions. If trenching is required, it is advised that the opportunity is taken to install sufficient conduits so that each parking bay can have a cable connection running to it from a central electrical distribution point.

Figure 30: Typical site layout for charging install



For new developments or redevelopments of existing sites, adding conduits or cable trays into the design of all car parking areas, servicing every parking bay is relatively low cost at the early stages. These measures will ensure that future charger installations can be done cost effectively and the overall cost over the course of a fleet transition is minimised.

Another major cost that may be incurred is upgrades to upstream grid infrastructure. These are triggered when the distributor's electrical infrastructure supplying the site reaches capacity. Infrastructure requiring upgrades can include transformers, cables or feeder mains, all the way up to major infrastructure such as zone substations.

If an application to connect additional load to the local distribution network triggers upstream upgrades, it is likely that the local grid operator will require the applicant to fund all or part of the cost. If capacity is available, then upgrades are either not required or minimal. An important consideration is that capacity is allocated by the distribution network service provider (DNSP) on a first come, first served basis. If it is identified that substantial capacity increases are required to implement onsite charging infrastructure, it is recommended that the DNSP is engaged early and applications lodged to identify any foreseeable costs. Accepting an offer to connect to the network or augment the existing capacity then reserves this capacity and provides cost certainty. The process from application to completion of upgrade can also be 18-24 months. The application itself does not commit the applicant to the works and gives clarity around cost implications.

Optimisation

Having a detailed understanding of the charging patterns of vehicles either through real world experience or granular emulation can identify infrastructure optimisation opportunities. It may be the case that not all vehicles will be charging at once and if it is possible to share chargers without affecting operational requirements then the total number of chargers installed at a site can be reduced. This can also include using multi-port chargers which can charge multiple vehicles from one station and are more cost effective than single-port.

One of the most cost-effective ways to reduce both upfront infrastructure costs and ongoing energy costs is through a load management system. This is a control system that interfaces with all the chargers on site and regulates their output to optimise for lowest cost or lowest impact on infrastructure. The system can ensure that charging only happens during certain times of day, remains below set thresholds and can also interface with fleet management or scheduling software to only charge how much is needed to fulfill service requirements. This requires chargers to be 'smart' or controllable and compatible with protocols such as OCPP or OPC. Some chargers are wireless, whereas others require an ethernet connection, so it is advisable to provision for enough space in cable trays or conduits to allow for an ethernet cable.

4.1.5 Charging infrastructure investment requirements

There are two key elements to capital expenditure required on each site - the cost of chargers and installation, and the costs associated with upgrading the electrical infrastructure on the site to support the new load from electric vehicles.

To assist DRC with planning and decision making, infrastructure upgrade cost guides are provided in Appendix D, Addendum 2. Charger and installation cost estimates are presented below by site. It is noteworthy that a number of sites are not expected to require infrastructure for charging over the coming 10-year outlook.

The overall cost of charging infrastructure for the ZEF Roadmap scenario is $259,200 and for the optimised ZEF Roadmap is $360,600. The following table presents cumulative charging infrastructure costs over the short, medium and long term for each ZEF Roadmap scenario.

Table 33: Cumulative charging infrastructure costs at key points in time

Location	ZEF Roadmap case			Optimised ZEF Roadmap case		
	Short term To 2022/23	Med term To 2025-26	Long term To 2030-31	Short term To 2022/23	Med term To 2025-26	Long term To 2030-31
Amaroo Drive Depot, Wellington	$0	$11,200	$22,400	$0	$16,200	$30,200
Macquarie Street Water Depot Ops	$0	$2,800	$2,800	$0	$2,800	$2,800
Dubbo CAB	$0	$0	$16,800	$0	$0	$28,000
Hawthorn Street Depot	$0	$20,600	$38,000	$0	$26,000	$58,800
Water Filtration Plant, Dubbo	$0	$0	$5,600	$0	$0	$5,600
Dubbo Sewage Treatment Plant	$0	$0	$5,600	$0	$0	$5,600
Whylandra Waste And Recycling Centre, Dubbo	$0	$2,800	$5,600	$0	$2,800	$5,600
Showground, Dubbo	$0	$0	$0	$0	$0	$2,800
Other Wellington	$0	$0	$5,600	$0	$5,600	$8,400
Wellington Caves	$0	$0	$2,800	$0	$0	$2,800
Private	$0	$42,000	$154,000	$0	$53,200	$210,000
Total	$0	$79,400	$259,200	$0	$106,600	$360,600

Sites deemed not requiring infrastructure over the coming 10 years

There are a number of sites within scope for analysis that have no vehicle assets moving to electric vehicle options over the 10 year timeframe according to the assumptions underpinning the results of this analysis. Examples include the Wellington Admin Building, Saleyards, Macquarie regional library, Dubbo Airport and the Rangers Animal Shelter.

4.2 Infrastructure management

4.2.1 Infrastructure deployment strategy

Understanding vehicle movements in and out of sites provides a good indication of the time that each vehicle has available to charge. For vehicles with daily routines, this is easily described and for most vehicles in the DRC fleet this was found to be the case.

The analysis undertaken has estimated a 14-hour overnight charging window available to all vehicles parked overnight either at Council owned sites or at private residences. An 8-hour office hours period is also assumed for vehicles charging during daylight hours

4.2.2 Site supply impacts and installed charging capacity

An analysis of the unconstrained load from the above noted charging stations is provided in the table below. This equates to the installed charging capacity at the site, except in the instance of private residences where this load is distributed across a number of sites.

Table 34: Installed charging capacity by site and year

Site	ZEF Scenario			Optimized ZEF Scenario		
	Short term to 2022/23	Med term to 2025-26	Long term to 2030-31	Short term to 2022/23	Med term to 2025-26	Long term to 2030-31
Amaroo Drive Depot, Wellington	0 kW	29.6 kW	59.2 kW	0 kW	51.8 kW	88.8 kW
Macquarie Street Water Depot	0 kW	7.4 kW	7.4 kW	0 kW	7.4 kW	7.4 kW
Dubbo CAB	0 kW	0 kW	44.4 kW	0 kW	0 kW	74 kW
Hawthorn Street Depot, Dubbo	0 kW	59.2 kW	118.4 kW	0 kW	103.6 kW	207.2 kW
Water Filtration Plant, Dubbo	0 kW	0 kW	14.8 kW	0 kW	0 kW	14.8 kW
Dubbo Sewage Treatment Plant	0 kW	0 kW	14.8 kW	0 kW	0 kW	14.8 kW
Whylandra Waste And Recycling Centre, Dubbo	0 kW	7.4 kW	14.8 kW	0 kW	7.4 kW	14.8 kW

Showground Dubbo	0 kW	0 kW	0 kW	0 kW	0 kW	7.4 kW
Other Wellington	0 kW	0 kW	14.8 kW	0 kW	14.8 kW	22.2 kW
Wellington Caves	0 kW	0 kW	7.4 kW	0 kW	0 kW	7.4 kW
Private	0 kW	111 kW	407 kW	0 kW	140.6 kW	555 kW

Calculating potential annual usage and demand charges

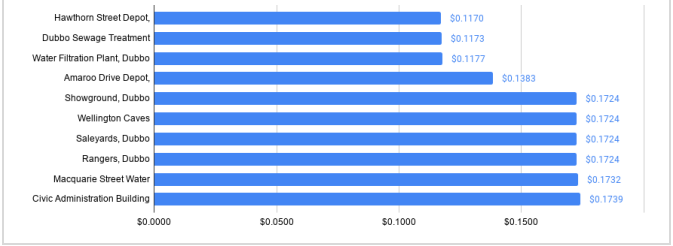
Variable charges (e.g. peak, shoulder, off-peak) typically depend on how much energy is used and at what time of day. Simple strategies such as delaying charging sessions to off peak periods are effective in reducing variable costs.

Demand and capacity charges are calculated from the maximum power draw (or load) of the site in any one time interval within a period of time. The capacity charge is based on the peak site load in the last year, while the demand charge is based on peak site load in the previous billing period.

A small number of low powered ZEV chargers may not increase the site load; however, adding more chargers or more powerful chargers may increase these costs.

The energy price structure for a number of sites was analysed to determine the marginal cost of energy and is presented by site in the table below:

Figure 31: Marginal cost of energy by site - ZEF Roadmap



Given the site-by-site variation in marginal cost of energy, a blended rate of 13.5c/kWh has been used in both heavy and light vehicle total cost of ownership modelling.

The private residence special case

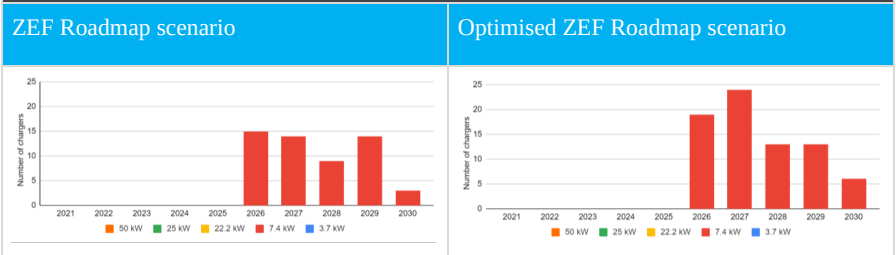
It can be logistically useful to charge vehicles that are garaged at private residences overnight at their private home. This can bring with it cost savings as the longer charging duration available overnight means a lower power, more cost effective charger can be used, and in time, charging infrastructure is more and more likely to be pre-existing in private residences. It can also avoid costly and disruptive upgrades on parking facilities.

There are many factors that need to be considered where the Council wishes to assist staff to install charging infrastructure, such as who pays for installation and operation (energy), and what happens when employees leave the organisation. In addition it needs to be acknowledged that those who live in apartments or do not have on-street parking will not be able to charge for the foreseeable future at home.

This analysis considers home charging to be possible for 97 of the 291 vehicles in the BCC fleet (one in three). No heavy or medium vehicles are required to charge at home to be operationally effective. During the working day, these cars may undertake operational duties at various locations, or commute to the multi deck car park for all-day parking, with some of these used as pool vehicles.

Home charging both enables vehicle performance and limits or offsets the requirement for expensive infrastructure installed at the workplace parking location. Vehicles charging at home can take advantage of the extended charging window to use a lower power charger, or in some cases make use of a simple standard wall-plug.

Figure 32: Home charger installations by year



Given that it is not possible to determine the accurate energy consumption relative to vehicle position at any time of day, this analysis has made the key assumption that none of the vehicles identified seeks to maintain sufficient charging levels using charging stations located away from the home, such as at Council sites. This should be considered a worst-case scenario.

4.2.3 Ensuring energy is sourced from renewable energy

There are four main ways in which renewable energy can be sourced:

1. Onsite generation and storage
2. Offsite Power Purchase Agreement (PPA)
3. Purchase of GreenPower™
4. Purchase of Large Scale Generation Certificates (LGCs)

Onsite generation and storage

Onsite solar is capital intensive upfront, but generates long term savings in both commodity and network costs of electricity. The challenge is maximising the utilisation of this energy, which means aligning vehicle charging times with optimal solar power generation times.
The amount of area required for solar panels to generate sufficient electricity to charge vehicles is also a limitation. As an example, a typical passenger vehicle driving 40km per day (15,000km/year) will need 6-8kWh of electricity, which can be generated by a 1.5-2kW solar system in NSW and will require 9-12m^2 of roof space. For heavy electric vehicles, the amount of roof space required to generate enough electricity to charge its battery is 200-400m^2.
Batteries can be used to store energy produced during the day for use at night, however they are not currently feasible for load shifting due to high upfront costs, however as these costs come down, batteries can be used to maximise the utilisation of solar energy.

Offsite PPA

Renewable energy can be purchased directly from a generation source through a PPA. Under this arrangement electricity is purchased through a contract with a solar or wind farm with fixed terms. The limitation with this approach is that PPAs are for the commodity component only and the electricity still needs to be transported using grid infrastructure, meaning network costs are still incurred. Network costs account for 30-50% of an electricity bill.

Large-scale solar PPA costs in 2020 were in the range of $44.50 – $61.50 per MWh[63], which is on par with current commodity spot prices of electricity. This means that with the right provider, renewable energy can be sourced through a PPA at the same cost as grid bought electricity.

A PPA will typically have more favourable pricing the longer the duration of the contract, the larger the load and the more predictable the load is. Long contract terms with fixed pricing and agreed escalation can suit some customers, but can also be challenging for others due to procurement policies.

Purchase of GreenPower™

GreenPower is a government-managed program that facilitates the purchase of renewable energy from accredited providers. Electricity customers can opt-in to buy varying percentages of renewable energy as a proportion of their total load, the pricing premium for GreenPower™ depends on this percentage, a table of forward pricing out to 2024 is provided below:

[63] https://arena.gov.au/renewable-energy/large-scale-solar/

Table 35: GreenPower pricing				
Year	GreenPower cost ($/MWh)			
	20%	50%	80%	100%
2022	$14.00	$24.65	$35.30	$42.40
2023	$9.60	$16.95	$24.30	$29.20
2024	$5.40	$9.60	$13.80	$16.60

Purchase of LGCs

These certificates are a mechanism for meeting obligations under the Renewable Energy Target (RET). They can be created by an accredited power station for every MWh of power generated and traded with liable entities. Under the RET the 2021 renewable power percentage (RPP) is 18.54%[64], meaning all energy purchased already has this cost passed through to consumers by retailers. Additional LGCs can be voluntarily purchased to make up 100% renewable energy, the cost of doing this is shown below.

Table 36: LGC pricing		
	LGCs only ($/MWh)	
	50% LGCs	100% LGCs
2022	$17.25	$34.50
2023	$11.75	$23.50
2024	$6.50	$13.00

To procure renewable energy for the balance of consumption, the best options are purchasing LGCs for smaller loads and for sites with high consumption (including in aggregate) consider negotiating a direct PPA with a wind or solar farm.

[64] http://www.cleanenergyregulator.gov.au/RET/Scheme-participants-and-industry/the-renewable-power-percentage#:~:text=The%202021%20renewable%20power%20percentage,(LRET)%20obligations%20for%202021.

SECTION 05:

OTHER KEY ENABLERS

5.1 Governance, policies and procedures

The ZEF Roadmap and Action Plan is strongly positioned for success with support from across different Departments of Council and a commitment to an evidence based plan. This section discusses various aspects of the governance and policy surrounding the electrification of the DRC fleet.

5.1.1 Governance considerations

Governance structures around the ZEF Roadmap and Action Plan are strong and well aligned with best practice. The process has senior project sponsors, a committed and aligned Project Manager, is informed by experienced leadership and has brought in external expertise to assist in planning for an economic, smooth transition.

The gentle approach to the zero emissions fleet transition provides sufficient information for leadership to make informed decisions, while minimising operational risks. The relaxed pace of fleet electrification based on some conservative assumptions, such as the potential holding period of light and heavy electric vehicles conversely, may lead to a higher overall total cost of ownership in an effort to mitigate operational risks.

Annual reviews of 10-year planning cycles introduce opportunities to update approaches and remain agile, but also provide a means to derail progress and reorient organisational expectations, both formally and through small, but meaningful barriers to annual progress.

The challenge of long-term Executive support, budget support and entrenching practices that reinforce the Plan is made easier by the fact the ZEF Roadmap is predicted to bring minor net economic savings over the 10-year period.

In the early phase of the ZEF Roadmap, more fleet assets will fall within the price-range for leasing, which will substantially adjust components of the associated fleet operating budget, while reducing the capital budget in line. Early decisions about whether to and how to support short-term changes to fleet budgeting will need to have a forward-focused eye to operational expenditure reductions, with the support of aligned policy and Executive.

5.1.2 Policy considerations

Transition and change brought forward through the ZEF Roadmap brings forth both challenge and opportunity as many of the effective policies and practices in existence today require adjustment or supplementation to remain effective. The ZEF Roadmap raises the following general fleet policy reviews, recommended for adoption in order to ensure the ongoing effectiveness of fleet policy through the electrification transition:

- Create an overarching *Fleet Vehicle Selection Policy* that documents overarching objectives and provides specific guidance around the parameters within which environmental objectives can be priced or accounted for.
- Gain specific commitment from the Executive Management Team on the decision-making process and policy around environmental objectives, particularly when there is a capex gap or shift on any one financial year or another.

- Introduce a transitional arrangement for the asset replacement schedule that abandons fixed 3 year (passenger) and 4 year cycles in order to best align electrification schedules with available technology and business cases.
- Introduce policies around data collection designed to support an informed and efficient transition to electric vehicles, and accounts for changing fleet demands.

5.1.3 Summary of existing fleet policies

There are currently several documents that are relevant to the procurement of vehicles, which are described below and in section "The Council's fleet, procurement and energy strategies".

Table 37: Documents relevant to fleet procurement

Document name	Document description
Management Policy: Fleet Services	Defines the roles of the Fleet and Depot Services Branch and describes the vehicle entitlements and conditions of use for council staff.
Fleet & Depot Services Procedure - Procurement	Describes the process followed in the acquiring and disposal of new vehicles/plant/small plant and equipment.
Government Pricing (Leaseback and Commercial)	List of vehicles with, Approved Vehicle List status and financial details
Whole of Life Costs (Leaseback and Commercial)	Detailed cost breakdown of Director, Manager, Staff level vehicles
10 Year Plant Asset Replacement Budget	10-year asset replacement budget

5.1.4 Additional policies to assist in the transition of ZEVs

Fleet management is a balancing act, and fleet policies recognise the need to balance:

- managing the fleet efficiently and safely;
- reducing environmental impact;
- optimising replacement times;
- focusing on reducing the need to travel generally;
- attracting and retaining staff; and
- innovation.

Further to the fleet policy amendments suggested in the previous chapter, Evenergi recommends the adoption of several new policies as described in the following table.

Table 38: Additional policies to assist in the transition of EVs

Suggested policy	Suggested content
Overarching fleet vehicle selection policy	Create an overarching Fleet Vehicle Selection Policy that refers to or subsumes the 'Fleet & Depot Services Procedure - Procurement' document and provides specific guidance around the parameters within which DRC's commercial objectives can be priced or accounted for. The purpose of this document is to ensure selected optimisations are enshrined in and empowered by policy.
Update maintenance policies	● Update maintenance policies in accordance with new ZEV related skill sets, see section "Describe the training necessary for Council staff to enable them to perform the electric vehicle servicing" ● Methods of tracking regular inspection, maintenance and repair per vehicle ● Methods of recording employee compliance with the maintenance schedule ● A defined communication system that keeps drivers trained and up-to-date on the latest maintenance procedures. ● Manufacturer-provided service schedules as a minimum frequency, adjusting for special use cases and upfitted equipment ● Approved vendors and parts ● Pre-authorised spend limits and payment methods ● Whether maintenance will be managed by time, mileage, hours, or a combination ● Whether maintenance varies by location or vehicle type ● What to do in the event of an emergency

5.1.5 Other considerations

In light of the suggested policy updates, there are a series of electric vehicle specific nuances that should be accounted for and managed accordingly. The below lists a range of tips to be considered as DRC engages in the transition to ZEVs.

- Introduce a transitional arrangement for the asset replacement schedule that abandons fixed 3 year (passenger) and 4 year cycles in order to best align electrification schedules with available technology.
- Establish a formal baseline requiring electric vehicle selection, and introduce specific fit-for-purpose attributes that may rule a use case inappropriate for electrification. This can be adjusted as technology, trends and requirements change.

- While beyond the scope of this report, GPS systems and Integrated Vehicle Management systems will greatly enhance the transition process through better data. This will be particularly important when purchasing new heavy electric vehicles.
- For light and heavy vehicles, procurement plans should reflect much longer lead times on electric vehicle procurements to account for supply constraints.
- It is recommended that DRC revise the capital and operational budgets in line with recommendations in this report.
- There will be very significant increases in energy costs, so building partnerships and capabilities in managing this demand will be key to optimising operational savings available from switching from traditional fuels to electric power.
- Home charging has been recommended where possible as it avoids or delays significant infrastructure upgrades. A full solution will need the introduction of policy updates as well as new back office expense claim processes.
- Consider implementing a work-place travel plan and survey. Reducing the fleet size can also potentially increase the utilisation of the remaining vehicles which will improve the TCO of electric vehicles, given that the further they drive the bigger the energy savings.
- A low-risk trial of car-share services is recommended, in replacement of a low-utilisation pool car. Such a project would be likely to save capital outlay, the cost involved in facilitating the movement of personnel, and can form part of internal communications activities designed to incentivise cleaner and lower cost travel choices, and avoidance of travel where possible.

5.2 Financing / Funding

5.2.1 Examples of councils financing their transition to zero emissions fleets

Although the operating costs of ZEVs can be lower than their ICE counterparts, they are currently more costly to purchase. Even though many councils at present buy vehicles outright in cash, the transition may have a material impact on upfront capital budgets, particularly when including charging infrastructure and site works.

Most commonly, councils will fund transitions out of existing capital budgets. In the early adopters any capital budget increases have been seen as part of their ESG targets. Specific examples of these types of approaches are :

1. Brisbane city council - has adopted their own carbon offset commitments which quantify the impact of emissions in diesel and petrol fleets and use the equivalent cost of emissions offsets to improve the business case to transition to ZEV, which can reduce the reliance on external financing and promote internal funding and approval.

2. Logan city council - has an environmental levy[65] which supports delivery of sustainability goals.

[65] https://www.logan.qld.gov.au/downloads/file/1968/environmental-levy-policy

For many, the purchasing decision for passenger vehicles is left to staff, as it is in the case of Dubbo, where appropriate passenger vehicles are selected by fleet team and then banded into levels based on the seniority of a role within council, and then the decision to purchase the vehicle is at the discretion of the driver. The end driver makes a fixed monthly contribution for the vehicles back to the councils.

There has been a perception that offering low cost finance may be an avenue to removing this barrier. Councils can currently borrow from NSW Treasury at low interest rates, so the finance offered by other 3rd parties is often seen as having to be at a lower cost than this cost of borrowing.

The Clean Energy Finance Corporation (CEFC) offers for customers and fleet companies to offer favourable loan interest rates for the purchase of zero emissions vehicles through a number of lenders[66]. A $50 million CEFC-financed program is encouraging business, government and not-for-profit fleet buyers to choose low emissions vehicles[67]. We contacted CEFC , however they were unable to confirm whether any local governments had taken up this offer.

Energy companies such as AGL and Origin have also begun to provide financing options and even specifically partner with FMOs on green transportation incentives. The Origin 360 EV Fleet program provides customers with tailored EV implementation strategies, fully managed vehicles, charging infrastructure, load management and cleaner travel through the inclusion of carbon offsets[68]. At this stage there have been no public announcements of local governments taking up these offers.

Many councils evaluate vehicles based on total cost of ownership, however when they do asset replacement plans they are not able to clearly link the purchase of the vehicles with a return on investment for the council through operating savings.

This is because the capital budgeting process is often separated from the operating costs budgets and there are external drivers such as the ability to capitalise costs, that make it difficult to link the two. Reports such as this one, are used to justify the shift in at a more strategic and holistic level and then best-practice involves changing the procurement policy to focus on whole-of-life based decisions.

Once that link is established more firmly, another step could be to determine, with finance, the cost of the depot for the council in general. If these vehicles can be financed at a lower cost, through green finance than the average cost of debt for the council overall, there may be merit in financing the vehicles through a debt mechanism.

66 www.environment.act.gov.au/__data/assets/pdf_file/0012/1188498/2018-21-ACTs-transition-to-zero-emissions-vehicles-Action-Plan-ACCESS.pdf

67 https://www.cefc.com.au/case-studies/finance-to-drive-uptake-of-low-emissions-vehicles/

68 https://www.originenergy.com.au/about/investors-media/media-centre/origin_launches_australian_first_ev_fleet_solution.html

5.2.2 Summarise the current or upcoming external funding or grants programs that might assist Council in its transition.

The following is a list of potential grants that may assist the council in its transition.

Table 39: Grant opportunities for local councils

Australia[69]	
Sustainable Cities/Green Vehicles - CEFC[70]	CEFC supports investment to accelerate the purchase of electric and plug-in hybrid electric vehicles, for individuals, small business and fleet buyers. They also finance start-up companies targeting the EV market through the Clean Energy Innovation Fund.
ERF[71]	Emission reduction fund (ERF) by Australian government incentivises businesses to cut their current GHG emissions by undertaking the activities that store carbon. Projects associated with transport fall into the category of eligible projects. Every tonne of emissions reduced or carbon stored can earn participants Australian carbon credit units (ACCU). Selling ACCUs can generate income for the businesses. There are currently no precedents of the ERF being used for Electric Vehicles.
Technology Co-investment fund[72]	A new $95.4 million fund was announced in September 2020 that will focus on supporting businesses in adopting technologies to enhance productivity and reduce emissions. The fund's main focus is manufacturing, industrial, and transport sectors and are unlikely to be used for Electric Vehicles.
Advancing renewables program - ARENA[73]	ARP with the focus on low emission priority technologies is continuously open for applications. BEVs are part of the priority technologies list as indicated in the Technology investment roadmap.[74]

[69] These country-wide programs also apply to NSW unless otherwise specified in eligibility criteria of being awardee of NSW specific programs

[70] https://www.cefc.com.au/where-we-invest/sustainable-economy/green-vehicles/

[71] https://www.industry.gov.au/funding-and-incentives/emissions-reduction-fund

[72] https://www.minister.industry.gov.au/ministers/taylor/media-releases/investment-new-energy-technologies

[73] https://arena.gov.au/funding/advancing-renewables-program/#step-1-read-the-program-guidelines

[74] https://consult.industry.gov.au/climate-change/technology-investment-roadmap/supporting_documents/technologyinvestmentroadmapdiscussionpaper.pdf

NSW	
Net zero industry and innovation program[75]	To realise the full opportunity of a low carbon NSW economy, this program aims at investing $750 million by 2030. Ultimately the programs will improve the economy, and lives of the families in NSW.
Electric Vehicle Infrastructure and Model Availability Program	Designed to fast-track the growth of the electric vehicle market in NSW, this program is understood to be opening mid 2021 with match funding. The investment will be targeted by running competitive funding processes that co-fund: ● the deployment of fast electric vehicle charging infrastructure, and; ● the procurement of electric vehicles by vehicle fleet owners such as car rental companies, car share companies and local councils.
ARENA - Future Fuels fund[76]	A new $74.5 million Future Fuels package announced in September 2020 will help businesses and regional communities take advantage of opportunities offered by hydrogen, electric, and bio-fuelled vehicles. Allocated into defined funding pools to support solutions for various technologies and challenges, the Future Fuels fund is set to see the imminent launching of a regional charging infrastructure fund to support projects enabling regional charging, especially targeted at those improving charging 'blackspots'. The fund is being managed by ARENA and launched in January 2021.
Unsolicited approaches	Unsolicited approach with a strategically aligned, clearly defined plan directly to Destination NSW, or other areas of the NSW Government or elected leaders.
ARENA[77]	If a novel project that involves grid integration can be developed, then the Australian Renewable Energy Agency can be a source of funding. This would likely need the involvement of Essential Energy. An example would be trialling off-grid or remote charging applications using solar and storage.

[75] https://energysaver.nsw.gov.au/sites/default/files/2021-03/NetZero-Industry-Innovation-Program_FINAL_24-March-21_webaccessible.pdf

[76] https://arena.gov.au/funding/future-fuels-fund/

[77] https://arena.gov.au/funding/

NSW Government Sustainability Advantage[78]	NSW Government Sustainability Advantage provides assistance and funding for businesses to deliver sustainability related projects - with electric vehicles being a stream of the program.
Environmental Upgrade Agreements[79]	Environmental Upgrade Agreements (EUAs) provide owners or managers with access to loans to upgrade a commercial building to maximise the building's energy efficiency. The EUA mechanism, while not a grant, may be a means of funding charging infrastructure upgrades.

[78] https://www.environment.nsw.gov.au/topics/sustainable-business-and-government/sustainability-advantage

[79] Building Upgrade Finance NSW | business.gov.au

SECTION 06:

Conclusions and recommendations

6.1 Conclusions

Continuing as is will see no new EVs or plug-in hybrids until 2026 due to the combination of mileage very large typical light vehicles less suited to lower emission vehicles in the market

The light vehicle electrification pathway sees electrification options becoming economically beneficial to procure from 2026.

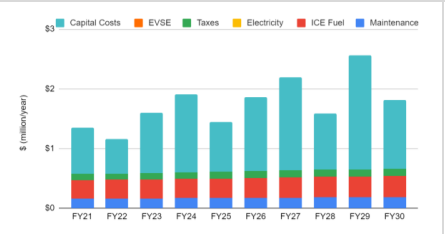
When considering some optimisations, hybrids start to enter the fleet immediately, which drives CO2 benefits with minimal extra costs

Opportunities exist to optimise fleet costs, with around $200,000 of savings identified per year through at the extreme end. This was predominantly achieved through selection of more economical options for higher utilisation assets and lower up-front cost examples for lower utilisation assets.

The following figure presents the 10 year total cost of ownership for the business as usual scenario against the standard and optimised ZEF Roadmap pathways for light vehicles.

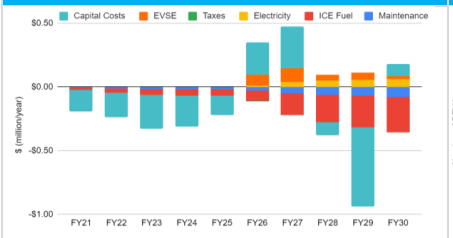
Figure 33: 10 year total cost of ownership and transitions per year - light vehicles

Business as usual scenario

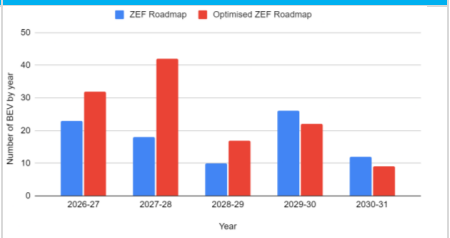


ZEF Roadmap scenario budget impact

Optimised scenario budget impact



Year ZEV replacement TCO beneficial



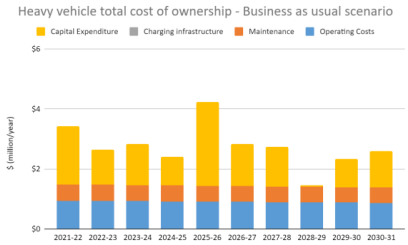
Heavy vehicle electrification is not likely to be commercially beneficial until purchases made in 2025/26, though pilot testing of vehicles is recommended sooner

The first technically sound and commercially beneficial heavy electric vehicle recommended for the DRC fleet is not scheduled to enter the fleet until 2025. Piloting these vehicles can be initiated immediately, with highly suitable asset ID 468 scheduled for replacement in the next 12 months. Piloting heavy electric vehicles will provide significant insights and business capability at low risk.

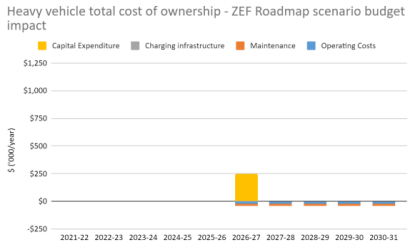
The following figure presents the 10 year total cost of ownership for the business as usual scenario against the standard and optimised ZEF Roadmap pathways for heavy vehicles.

Figure 34: 10 year total cost of ownership and year of transition - heavy vehicles

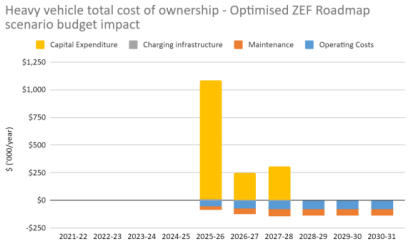
Business as usual scenario



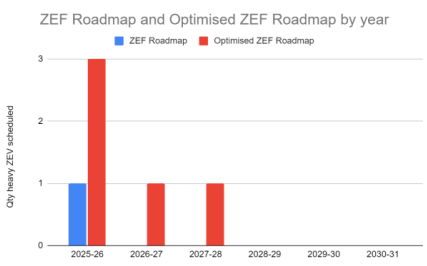
ZEF Roadmap scenario budget impact



Optimised scenario budget impact



Year ZEV replacement TCO beneficial

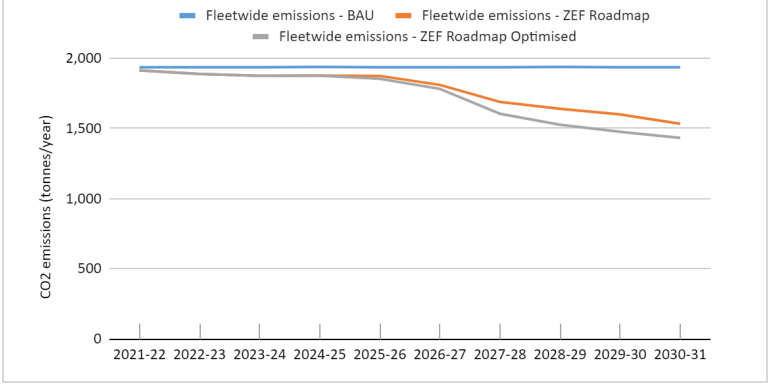


A zero emissions roadmap with minimal budget impact will lower fleet emissions by around 10% over the next 10 years

Choosing more efficient internal combustion vehicles in the short term can improve total cost of ownership and emissions results, as captured in the period 2021-25. Emissions improvements gain pace from 2025 as the TCO parity point for many segments of vehicle is reached and zero emissions vehicles begin entering the fleet.

Around 25% of annual fleet emissions can be removed under the ZEF Roadmap and optimised ZEF Roadmap scenarios by 2030, but significant emissions are locked in over the interim period.

Figure 35: Emissions results by scenario over 10 year period of analysis



Emissions outcomes can be improved relative to the tested scenarios with targeted fleet policies, with minimal budget impact

This analysis determined that very few vehicles will move to zero emissions options until 2025 and beyond. Applying a hard-line approach to total cost of ownership ignored the many vehicle replacement decisions points with minimally worse TCO. There are many vehicles offering a very low lifetime cost of emissions abated by replacing the vehicle one cycle earlier.

116 replacement decision points in Evenergi's analysis had a TCO gap of less than $5,000, with 18 of those having a TCO gap of less than $500.

2020 represented a turning point in the EV market in Australia and particularly in NSW

In 2020, the NSW Government has turned the corner on its commitment to electric vehicles. This year saw the release of the first dedicated grant for electric vehicle fleets from the NSW Government, commitment to 100% electrify their bus fleet by 2030, funding for charging infrastructure and several other measures. Most importantly for DRC is the announcement of specific funding for fleet transition in NSW, and that local government will be eligible to apply.

The ACT Government has brought in even stronger commitments in the coming 2-3 years, and the Federal Government has announced a 72 million dollar Future Fuels fund dedicated to zero emission vehicles.

2020 also saw the release of the first electric vehicle in Australia at a price point near $40,000, while Australian importer Nexport has recently committed to importing BYD vehicles at price points in the mid-$30,000 bracket. Nexport announcements have yet to be market tested.

The eventual transition is inevitable - vehicle manufacturers have shifted investment to electric vehicles and traditional vehicle availability will wane

Fleet planning going forwards will be heavily shaped by global pressures on vehicle manufacturers. Vehicle availability and price will change, with these pressures likely to result in noticeably changing fleet procurement dynamics from around 2025.

Charging infrastructure investment focuses around three sites, while charging at home becomes a significant factor

Amaroo Drive Depot, Hawthorn Street Depot and CAB are the three sites most impacted by growth in annual power demand through proposed electric vehicle adoption over the coming 10 years, with Hawthorn depot experiencing a quadrupling of peak energy demand.

The cost of charging infrastructure expected over the 10 year period analysed was $259,200 under the ZEF Roadmap scenario and $360,600 under the optimised ZEF Roadmap scenario.

The additional load to these three key sites will need to be managed by 2030 to limit site connection upgrade costs, with the worst-case additional simultaneous load as much as or beyond the current site connection size.

More than half of additional electrical load is expected to come from electric vehicles replacing vehicles that are currently garaged at home overnight. Overnight charging is significantly more cost effective and relying on this strategy can help to delay or completely offset expensive site upgrades and upstream electricity network upgrades.

6.2 ZEF Roadmap Action Plan

The following tables present detailed action, purpose, timing, owner, budget and output for actions identified under the following themes:

- Policy;
- Light fleet;
- Heavy fleet;
- Infrastructure; and
- Other

This plan is based on the context of some of the key drivers of vehicle availability and price points.

Table XX

	2021	2025	2030
Utes	Market very limited. Viability dependant on specific asset. **$$$$**	Market established. Viability dependant on specific asset. **$$**	Many options exist. Good viability in most use cases. **$**
Passenger vehicles & SUVs	Some options within market rapidly maturing. Viability dependant on specific asset. **$$**	Many options exist. Improving viability and viable in many use cases. **$**	Many options exist. Good viability in most use cases. **$**
Light commercial	Market established for small vehicles.. Viability dependant on specific asset. **$$**	Market established in all sizes. Viability dependant on specific asset. **$$**	Many options exist. Good viability in most use cases. **$**
Heavy vehicles	Viability dependant on specific asset. **$$**	Viability dependant on specific asset. Technical limitations are diminishing. **$$**	Many options exist. Viability dependant on specific asset. Technical limitations are diminishing. **$**
Heavy Plant	Market established for a few types only. Viability dependant on specific asset. **$$$$**	Market options improve. Viability dependant on specific asset. **$$$**	Market options improve. Viability dependant on specific asset. **$**
Light Plant Equipment	Viability dependant on specific asset. **$$**	Viability dependant on specific asset. **$$**	Many options exist. Good viability in most use cases. **$**

$$$$** = Very expensive, not economically practical **$$** = Capital intensive but potentially viable on TCO **$ = Viable in most cases on TCO

6.2.1 Action plan theme - Policy

Table 40 - Theme: Policy

Action	Purpose	Timing	Owner	Budget	Output
Implement new vehicle selection policy	Policy will be the most concrete way to institutionalise change agreed to by the fleet team. Some modifications to holding policies, financial evaluation	Short	Fleet	NA	*New policy for adoption*
Include zero emissions vehicles on leaseback options	Adding zero emissions vehicles to the short-list for all three tiers of leaseback options available to DRC staff is a move that would likely see a proportion of staff choose to drive zero emissions options.	Short	Fleet	None	New fleet lease-back list
Annual budgeting approach changed to reflect zero emissions fleet transition.	Current Council budgeting does not include charging infrastructure and reflects the total cost budget including increased capital and reduced operating costs of zero emission vehicles.	Mid	Fleet	$3,000 per annum	New annual asset renewal planning process
Vehicle leaseback shortlisting process	Consider a policy that segments vehicle options by FCAI segment and provides the two most TCO optimised vehicles per segment for each level of vehicle options would provide improved diversity of options, lower TCO, and improved emissions outcomes.	Short	Fleet	None	New vehicle leaseback shortlisting process
Maintenance	Update maintenance guidelines to reflect new skills required for EVs	Mid	Fleet	TBD	Servicing guidelines

Data collection	Data drives improved fleet intelligence, which becomes increasingly critical during a major fleet upheaval / technology interruption.	Short	Fleet	$750 - $7,500	Vehicle performance data, responsible member of fleet

6.2.2 Action plan theme - Light vehicle fleet

Table 41 - Theme: Light fleet

Action	Purpose	Timing	Owner	Budget	Output
Implement an overarching *Fleet Vehicle Selection Policy* that documents overarching objectives and provides specific guidance around the parameters within which environmental objectives can be priced or accounted for.	Policy will be the most concrete way to institutionalise change agreed to by Fleet.	Short	Fleet	NA	*New policy for adoption*
Gain specific commitment from the Executive Management Team on the decision-making process and policy around environmental objectives, particularly when there is a capex gap or shift on any one financial year or another.	Executive commitment enables consideration of budget adjustments.	Short	Fleet	NA	*New budgets if required*
Identify at least 2 passenger vehicles that could be transitioned and apply for state government grant funding so that some early wins can be secured even where TCO does not meet parity	Achieve up to $20,000 in savings in early years through grant applications and get a visibly growing EV fleet of passenger vehicles.	Short	Fleet	$2,500	Purchase of 3-5 passenger vehicles by end of 2021

6.2.3 Action plan theme - Heavy vehicle fleet

Table 42 - Theme: Heavy vehicle fleet

Action	Purpose	Timing	Owner	Budget	Output
Develop tools to accurately assess payload	Given lower range of heavy electric vehicles, it is more important to accurately assess payload	Mid	Fleet	TBD	More accurate payload understanding
Pilot and learn procure first heavy electric vehicle. Track and monitor performance and understand fit for purpose for rest of fleet	To be ready for future purchases	Short	Fleet	Additional vehicle cost may be $80,000 on a TOTEX basis	Lessons learnt report
Track availability of heavy zero emission vehicles	This is a fast moving space and an inventory of vehicle availability and alerts as to new arrivals will be key	Mid	Fleet	$500 p.a	Annual update to team
Collect, store, and start to analyse vehicle battery information	Understand actual performance in duty will help future procurements and manage disposal values	Mid	Fleet	$2,500	Lessons learnt report and data

6.2.4 Action plan theme - Infrastructure

Table 43 - Theme: Infrastructure

Action	Purpose	Timing	Owner	Budget	Output
Develop a charging infrastructure strategy and software architecture that includes home, depot, and on-street charging requirements.	There will be a medium term need for charging infrastructure management software	Mid	Sustainability	$5,000	Software architecture ready for RFQ
Investigate charging policy and method for fleet assets which are primarily home garaged	Many vehicles are home garaged This change is complex, but may be a better cost option than upgrading infrastructure in facilities.	Mid	Sustainability	$1,000	Home charging policy

6.2.5 Action plan theme - Other actions

Table 44 - Theme: Other actions

Action	Purpose	Timing	Owner	Budget	Output
Maintain in-house servicing where possible and retrain staff	Current inhouse servicing is cost effective. Retaining staff will add value to staff and DRC.	Mid	Fleet	TBD	Staff skills and training courses
Update safety policies	It is recommended to consult SafeWork NSW in development of procedures and policies in support of safe work around high voltage systems in hybrid, plugin hybrid and battery electric vehicles.	Mid	Fleet	TBD	Updated safety policies
Driver training and education	Staff education on EVs including drive days out of the pressure of daily use to enable familiarisation with the new generation of EV technology will drive higher utilisation (and better TCO) and acceptance.	Short	Sustainability	$1,000	Driver training program
Hydrogen roadmap - Council attend meetings and collaborations around maximising the potential investment by Commonwealth and NSW Governments as well as from private investors	The NSW Government is in the planning stage for the state's first Renewable Energy Zone in the Central-West Orana region, around Dubbo and Wellington. The REZ may create an opportunity for Council.	Mid	Sustainability/ Fleet	NA	Attend meetings