

# Appendix Y Greenhouse gas assessment



Public Transport  
Authority



# Malaga to Ellenbrook RailWorks Greenhouse Gas Assessment 22 July 2020

METRONET- CO<sub>2</sub> Emission savings MEL

General Inputs

Base year	2020
First full year of Operation MEL	2026
Final Year modeled	2074
Discount Rate	7%
Extrapolation factor	2.820%
Ramp up factor year 1	79%
Ramp up factor year 2	95%
Ramp up factor year 3 onwards	100%
Annualisation factor	338

CO<sub>2</sub> Conversion factor

Fuel Combusted	Energy Content Factor (Gj/kl)	Conversion Factor (kg CO <sub>2</sub> /lt)	Conversion Factor (tonne CO <sub>2</sub> /lt)
Gasoline	34.20	2.31	0.0023
Diesel Oil	38.60	2.70	0.0027
Fuel Oil	39.70	2.92	0.0029
Average		2.64	0.00264

Electricity	Energy content (GJ/MWh)	Emission factor, scope 2 (kg CO <sub>2</sub> e/kWh)	Emission factor, scope 3 (kg CO <sub>2</sub> e/kWh)	Emission factor, scope 2+3 (kg CO <sub>2</sub> e/kWh)
Australian grid	3.60	0.79	0.09	0.8800
Electricity, ACT grid	3.60	0.81	0.09	0.9000
Electricity, NSW grid	3.60	0.81	0.09	0.9000
Electricity, NT grid	3.60	0.63	0.08	0.7100
Electricity, QLD grid	3.60	0.81	0.12	0.9300
Electricity, SA grid	3.60	0.44	0.10	0.5300
Electricity, Tas grid	3.60	0.15	0.02	0.1700
Electricity, Vic grid	3.60	1.02	0.10	1.1200
Electricity, WA grid	3.60	0.69	0.04	0.74000

GHG - Estimates

Base	2021	2026	2041	Whole of Life <sup>^</sup>
Fuel Consumption (lt) yearly - Base	0	2,089,943,570	2,894,549,183	
Construction CO <sub>2</sub> Emissions (tonnes)	TBC	0	0	0
Operational Energy Consumption (kWh)	0	0	4,696,848	829,691,465
MEL- Project	2021	2026	2041	Whole of Life <sup>^</sup>
Fuel Consumption (lt) yearly - Project	0	2,082,366,641	2,882,275,406	
Construction CO <sub>2</sub> Emissions (tonnes)	TBC	0	0	0
Operational CO <sub>2</sub> Emissions (tonnes)	0		0	4,067
Net Outcome	2021	2026	2041	Whole of Life <sup>^</sup>
Fuel CO <sub>2</sub> Emission savings (tonnes)	0	20,028	12,415	2,193,151
Construction CO <sub>2</sub> Emissions (tonnes)	TBC	TBC	TBC	TBC
Operational CO <sub>2</sub> Emissions (tonnes)	0	-13,479	-3,583	-831,592
CO <sub>2</sub> Emission savings (tonnes)	TBC	6,550	8,832	1,361,559

\* The energy content factor and emission factor are from Department of the Environment and Energy, Table 4 Fuel combustion emission factor-fuels used for transport energy purpose.

<sup>^</sup> Whole of Life refers modelled duration with estimated commencement of construction emissions in 2021 and commencement of operation between 2026 to 2074.

METRONET- CO<sub>2</sub> Emission savings MEL

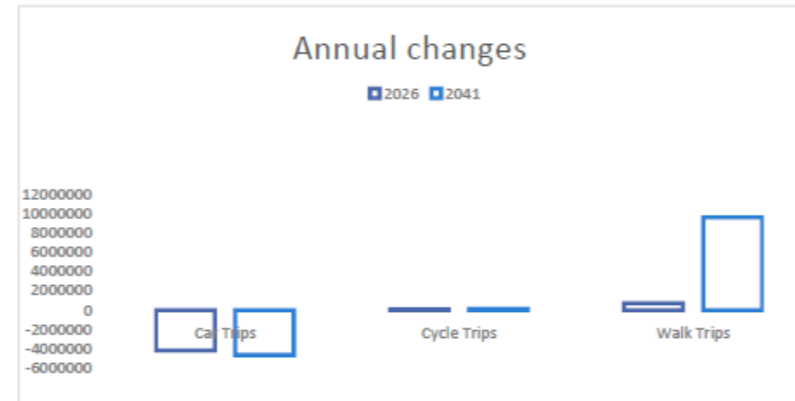
Calendar Year	Construction														
	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Financial Year From	1-Jul-20	1-Jul-21	1-Jul-22	1-Jul-23	1-Jul-24	1-Jul-25	1-Jul-26	1-Jul-27	1-Jul-28	1-Jul-29	1-Jul-30	1-Jul-31	1-Jul-32	1-Jul-33	1-Jul-34
Financial Year To	30-Jun-21	30-Jun-22	30-Jun-23	30-Jun-24	30-Jun-25	30-Jun-26	30-Jun-27	30-Jun-28	30-Jun-29	30-Jun-30	30-Jun-31	30-Jun-32	30-Jun-33	30-Jun-34	30-Jun-35
<b>Morley - Ellenbrook Line (MEL) - Annual Savings</b>															
<b>GHG Savings - Incremental</b>															
Fuel CO <sub>2</sub> Emission savings (tonnes)	0	0	0	0	0	15,822	19,813	21,684	22,511	23,339	24,167	24,994	25,822	26,650	27,478
Construction CO <sub>2</sub> Emissions (tonnes)	TBC	TBC	TBC	TBC	TBC	0	0	0	0	0	0	0	0	0	0
Operational CO <sub>2</sub> Emissions (tonnes)	0	0	0	0	0	-13,479	-16,209	-17,062	-17,062	-17,062	-17,062	-17,062	-17,062	-17,062	-17,062
Estimated Total CO <sub>2</sub> Emissions (tonnes)	TBC	TBC	TBC	TBC	TBC	2,344	3,605	4,622	5,450	6,277	7,105	7,933	8,760	9,588	10,416
<b>Base Case</b>															
Construction CO <sub>2</sub> Emissions (tonnes)	TBC	TBC	TBC	TBC	TBC	0	0	0	0	0	0	0	0	0	0
Operational Energy Consumption (kWh)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fuel Consumption (lt) yearly - Base	0	0	0	0	0	1,651,055,420	2,036,404,747	2,197,224,318	2,250,864,693	2,304,505,067	2,358,145,441	2,411,785,815	2,465,426,190	2,519,066,564	2,572,706,938
<b>Project Case</b>															
Construction CO <sub>2</sub> Emissions (tonnes)	TBC	TBC	TBC	TBC	TBC	0	0	0	0	0	0	0	0	0	0
Operational Energy Consumption (kWh)	0	0	0	0	0	18,214,631	21,903,670	23,056,495	23,056,495	23,056,495	23,056,495	23,056,495	23,056,495	23,056,495	23,056,495
Fuel Consumption (lt) yearly - Project	0	0	0	0	0	1,645,069,646	2,028,909,197	2,189,021,143	2,242,348,394	2,295,675,645	2,349,002,896	2,402,330,147	2,455,657,398	2,508,984,649	2,562,311,900

Other Benefits

Incremental/daily	2026	2041
Car Trips	-12,393	-13,781
Cycle Trips	246	345
Walk Trips	2,074	28,344

Incremental/annual	2026	2041
Car Trips	-4,188,834	-4,657,978
Cycle Trips	83,020	116,749
Walk Trips	700,850	9,580,252



METRONET- CO<sub>2</sub> Emission savings MEL

Calendar Year	Operation														2050
	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Financial Year From	1-Jul-35	1-Jul-36	1-Jul-37	1-Jul-38	1-Jul-39	1-Jul-40	1-Jul-41	1-Jul-42	1-Jul-43	1-Jul-44	1-Jul-45	1-Jul-46	1-Jul-47	1-Jul-48	1-Jul-49
Financial Year To	30-Jun-36	30-Jun-37	30-Jun-38	30-Jun-39	30-Jun-40	30-Jun-41	30-Jun-42	30-Jun-43	30-Jun-44	30-Jun-45	30-Jun-46	30-Jun-47	30-Jun-48	30-Jun-49	30-Jun-50
<b>Morley - Ellenbrook Line (MEL) - Annual Savings</b>															
<b>GHG Savings - Incremental</b>															
Fuel CO <sub>2</sub> Emission savings (tonnes)	28,305	29,133	29,961	30,788	31,616	32,444	33,359	34,299	35,267	36,261	37,284	38,335	39,416	40,528	41,670
Construction CO <sub>2</sub> Emissions (tonnes)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Operational CO <sub>2</sub> Emissions (tonnes)	-17,062	-17,062	-17,062	-17,062	-17,062	-17,062	-17,062	-17,062	-17,062	-17,062	-17,062	-17,062	-17,062	-17,062	-17,062
Estimated Total CO <sub>2</sub> Emissions (tonnes)	11,243	12,071	12,899	13,726	14,554	15,382	16,297	17,238	18,205	19,199	20,222	21,273	22,354	23,466	24,609
<b>Base Case</b>															
Construction CO <sub>2</sub> Emissions (tonnes)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Operational Energy Consumption (kWh)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fuel Consumption (lt) yearly - Base	2,626,347,312	2,679,987,686	2,733,628,061	2,787,268,435	2,840,908,809	2,894,549,183	2,976,175,470	3,060,103,618	3,146,398,541	3,235,126,979	3,326,357,560	3,420,160,843	3,516,609,379	3,615,777,764	3,717,742,697
<b>Project Case</b>															
Construction CO <sub>2</sub> Emissions (tonnes)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Operational Energy Consumption (kWh)	23,056,495	23,056,495	23,056,495	23,056,495	23,056,495	23,056,495	23,056,495	23,056,495	23,056,495	23,056,495	23,056,495	23,056,495	23,056,495	23,056,495	23,056,495
Fuel Consumption (lt) yearly - Project	2,615,639,151	2,668,966,402	2,722,293,653	2,775,620,904	2,828,948,155	2,882,275,406	2,963,555,573	3,047,127,840	3,133,056,845	3,221,409,048	3,312,252,783	3,405,658,311	3,501,697,876	3,600,445,756	3,701,978,326

METRONET- CO<sub>2</sub> Emission savings MEL

Calendar Year	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065
Financial Year From	1-Jul-50	1-Jul-51	1-Jul-52	1-Jul-53	1-Jul-54	1-Jul-55	1-Jul-56	1-Jul-57	1-Jul-58	1-Jul-59	1-Jul-60	1-Jul-61	1-Jul-62	1-Jul-63	1-Jul-64
Financial Year To	30-Jun-51	30-Jun-52	30-Jun-53	30-Jun-54	30-Jun-55	30-Jun-56	30-Jun-57	30-Jun-58	30-Jun-59	30-Jun-60	30-Jun-61	30-Jun-62	30-Jun-63	30-Jun-64	30-Jun-65
<b>Morley - Ellenbrook Line (MEL) - Annual Savings</b>															
<b>GHG Savings - Incremental</b>															
Fuel CO <sub>2</sub> Emission savings (tonnes)	42,846	44,054	45,296	46,574	47,887	49,237	50,626	52,053	53,521	55,031	56,583	58,178	59,819	61,506	63,240
Construction CO <sub>2</sub> Emissions (tonnes)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Operational CO <sub>2</sub> Emissions (tonnes)	-17,062	-17,062	-17,062	-17,062	-17,062	-17,062	-17,062	-17,062	-17,062	-17,062	-17,062	-17,062	-17,062	-17,062	-17,062
Estimated Total CO <sub>2</sub> Emissions (tonnes)	25,784	26,992	28,234	29,512	30,825	32,175	33,564	34,992	36,460	37,969	39,521	41,116	42,757	44,444	46,178
<b>Base Case</b>															
Construction CO <sub>2</sub> Emissions (tonnes)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Operational Energy Constumtion (kWH)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fuel Consumption (It) yearly - Base	3,822,583,041	3,930,379,882	4,041,216,595	4,155,178,903	4,272,354,948	4,392,835,358	4,516,713,315	4,644,084,630	4,775,047,817	4,909,704,165	5,048,157,823	5,190,515,873	5,336,888,421	5,487,388,674	5,642,133,035
<b>Project Case</b>															
Construction CO <sub>2</sub> Emissions (tonnes)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Operational Energy Constumtion (kWH)	23,056,495	23,056,495	23,056,495	23,056,495	23,056,495	23,056,495	23,056,495	23,056,495	23,056,495	23,056,495	23,056,495	23,056,495	23,056,495	23,056,495	23,056,495
Fuel Consumption (It) yearly - Project	3,806,374,115	3,913,713,865	4,024,080,596	4,137,559,669	4,254,238,852	4,374,208,387	4,497,561,064	4,624,392,286	4,754,800,148	4,888,885,512	5,026,752,084	5,168,506,493	5,314,258,376	5,464,120,462	5,618,208,659

METRONET- CO<sub>2</sub> Emission savings MEL

Calendar Year	2066	2067	2068	2069	2070	2071	2072	2073	2074
Financial Year From	1-Jul-65	1-Jul-66	1-Jul-67	1-Jul-68	1-Jul-69	1-Jul-70	1-Jul-71	1-Jul-72	1-Jul-73
Financial Year To	30-Jun-66	30-Jun-67	30-Jun-68	30-Jun-69	30-Jun-70	30-Jun-71	30-Jun-72	30-Jun-73	30-Jun-74
<b>Morley - Ellenbrook Line (MEL) - Annual Savings</b>									
<b>GHG Savings - Incremental</b>									
Fuel CO <sub>2</sub> Emission savings (tonnes)	65,023	66,857	68,743	70,681	72,674	74,724	76,831	78,998	81,225
Construction CO <sub>2</sub> Emissions (tonnes)	0	0	0	0	0	0	0	0	0
Operational CO <sub>2</sub> Emissions (tonnes)	-17,062	-17,062	-17,062	-17,062	-17,062	-17,062	-17,062	-17,062	-17,062
Estimated Total CO <sub>2</sub> Emissions (tonnes)	47,962	49,795	51,681	53,619	55,612	57,662	59,769	61,936	64,163
<b>Base Case</b>									
Construction CO <sub>2</sub> Emissions (tonnes)	0	0	0	0	0	0	0	0	0
Operational Energy Constumtion (kWH)	0	0	0	0	0	0	0	0	0
Fuel Consumption (It) yearly - Base	5,801,241,187	5,964,836,188	6,133,044,569	6,305,996,425	6,483,825,525	6,666,669,404	6,854,669,482	7,047,971,161	7,246,723,948
<b>Project Case</b>									
Construction CO <sub>2</sub> Emissions (tonnes)	0	0	0	0	0	0	0	0	0
Operational Energy Constumtion (kWH)	23,056,495	23,056,495	23,056,495	23,056,495	23,056,495	23,056,495	23,056,495	23,056,495	23,056,495
Fuel Consumption (It) yearly - Project	5,776,642,143	5,939,543,451	6,107,038,577	6,279,257,065	6,456,332,114	6,638,400,680	6,825,603,579	7,018,085,600	7,215,995,614