Technical Report No. 6

Air Emissions Inventory for the Greater Metropolitan Region in New South Wales

2008 Calendar Year

Off-Road Mobile Emissions: Results

ACKNOWLEDGMENTS

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EXECUTIVE SUMMARY

An air emissions inventory project for off-road mobile sources has take over 2 years to complete. The base year of the off-road mobile inventory represents activities that took place during the 2008 calendar year and is accompanied by emission projections in yearly increments up to the 2036 calendar year. The area included in the inventory covers the greater Sydney, Newcastle and Wollongong regions, known collectively as the Greater Metropolitan Region (GMR).

The inventory region defined as the GMR measures 210 km (east–west) by 273 km (north–south). The inventory region is presented in Table ES-1 and shown in Figure ES-1.

Table ES-1: Definition of Greater Metropolitan, Sydney, Newcastle and Wollongong regions

Region	South-west corner MGA[1] coordinates		North-east corner MGA coordinates	
	Easting (km)	Northing (km)	Easting (km)	Northing (km)
Greater Metropolitan	210	6159	420	6432
Sydney	261	6201	360	6300
Newcastle	360	6348	408	6372
Wollongong	279	6174	318	6201

The off-road mobile air emissions inventory includes emissions from the following sources/activities:

- Aircraft (flight operations);
- Aircraft (ground operations);
- Commercial boats;
- Commercial off-road vehicles and equipment;
- Industrial off-road vehicles and equipment;
- Locomotives;
- Recreational boats; and
- Ships.

[1] Map Grid of Australia based on the Geocentric Datum of Australia 1994 (GDA94) (ICSM, 2006).

The pollutants inventoried include criteria pollutants specified in the Ambient Air Quality NEPM (NEPC, 2003), air toxics associated with the National Pollutant Inventory NEPM (NEPC, 2008) and the Air Toxics NEPM (NEPC, 2004), and any other pollutants associated with state-specific programs, i.e. Load Based Licensing (Protection of the Environment Operations (General) Regulation 2009 (PCO, 2010b)) and the Protection of the Environment Operations (Clean Air) Regulation 2010 (PCO, 2011).

Figure ES-1: Definition of Greater Metropolitan, Sydney, Newcastle and Wollongong regions

Table ES-2 presents total estimated annual emissions (for selected substances) from all off-road mobile sources in the whole GMR and the Sydney, Newcastle and Wollongong regions. Total estimated annual emissions are also presented for the region defined as Non Urban. This region is the area of the GMR minus the combined areas of the Sydney, Newcastle and Wollongong regions. The selected substances were chosen because they:

- Are the most common air pollutants found in airsheds according to the National Pollutant Inventory NEPM (NEPC, 2008);
- Are referred to in NEPMs for ambient air quality (NEPC, 2003) and air toxics (NEPC, 2004), and
- Have been classified as priority air pollutants (NEPC, 2006).

Table ES-2: Total estimated annual emissions from off-road mobile sources in each region

Substance	Emissions (tonne/year)				
	Newcastle	Non Urban	Sydney	Wollongong	GMR
1,3-BUTADIENE	2.78	18	18	1.16	40
ACETALDEHYDE	9.97	151	47	4.26	212
BENZENE	31	196	164	13	404
CARBON MONOXIDE	3,343	27,975	20,801	1,698	53,817
FORMALDEHYDE	22	333	113	11	478
ISOMERS OF XYLENE	112	596	602	45	1,356
LEAD & COMPOUNDS	5.85×10^{-2}	0.85	1.28	3.0×10^{-2}	2.22
OXIDES OF NITROGEN	3,548	31,826	16,238	1,598	53,210
PARTICULATE MATTER ≤ 10 µm	284	2,185	1,019	119	3,607
PARTICULATE MATTER ≤ 2.5 µm	266	2,104	952	112	3,433
PERCHLOROETHYLENE	1.77×10^{-5}	6.80×10^{-5}	5.80×10^{-4}	1.24×10^{-4}	7.89×10^{-4}
POLYCYCLIC AROMATIC HYDROCARBONS	0.73	3.18	5.02	0.31	9.24
SULFUR DIOXIDE	1,300	1,246	4,725	553	7,824
TOLUENE	105	566	563	43	1,276
TOTAL SUSPENDED PARTICULATE	294	2,276	1,056	123	3,749
TOTAL VOLATILE ORGANIC COMPOUNDS	1,303	8,715	7,341	591	17,950

Figure ES-2 shows the proportions of total estimated annual emissions (for selected substances) from off-road mobile sources in the whole GMR and the Sydney, Newcastle, Wollongong and Non Urban regions.

Figure ES-2: Proportions of total estimated annual emissions from off-road mobile sources in each region

Table ES-3, Table ES-4, Table ES-5, Table ES-6 and Table ES-7 present total estimated annual emissions (for selected substances) from each off-road mobile source type in the whole GMR and the Sydney, Newcastle, Wollongong and Non Urban regions, respectively.

Figure ES-3, Figure ES-4, Figure ES-5, Figure ES-6 and Figure ES-7 show the proportions of total estimated annual emissions (for selected substances) from each off-road mobile source type in the whole GMR and the Sydney, Newcastle, Wollongong and Non Urban regions, respectively.

Table ES-3: Total estimated annual emissions by off-road mobile source type in the GMR

Substance	Emissions (tonne/year)								
	Aircraft (flight operations)	Aircraft (ground operations)	Commercial boats	Commercial off-road vehicles and equipment	Industrial off-road vehicles and equipment	Locomotives	Recreational boats	Ships	Off-Road Mobile Total
1,3-BUTADIENE	3.86	0.13	12	9.42×10^{-2}	6.48	0.95	16	4.71×10^{-2}	40
ACETALDEHYDE	9.88	3.68	17	1.01	160	6.93	12	1.82	212
BENZENE	3.91	1.60	134	0.65	65	0.80	193	4.60	404
CARBON MONOXIDE	3,128	1,895	12,153	256	20,431	906	14,585	463	53,817
FORMALDEHYDE	29	8.20	33	2.99	366	15	20	3.84	478
ISOMERS OF XYLENE	1.03	0.76	542	0.60	38	1.72	770	2.35	1,356
LEAD & COMPOUNDS	1.71	4.58×10^{-4}	0.17	6.15×10^{-4}	7.32×10^{-2}	2.01×10^{-2}	0.23	2.39×10^{-2}	2.22
OXIDES OF NITROGEN	1,850	265	4,404	162	30,716	6,087	301	9,425	53,210
PARTICULATE MATTER ≤ 10 µm	58	15	193	11	2,094	171	143	922	3,607
PARTICULATE MATTER ≤ 2.5 µm	49	14	182	10	2,031	166	132	849	3,433
PERCHLOROETHYLENE	-	-	-	4.96×10^{-5}	7.39×10^{-4}	-	-	-	7.89×10^{-4}
POLYCYCLIC AROMATIC HYDROCARBONS	2.80	1.52×10^{-2}	0.37	1.73×10^{-2}	2.28	0.45	0.34	2.95	9.24
SULFUR DIOXIDE	167	1.97	15	0.41	64	11	7.46	7,557	7,824
TOLUENE	1.44	1.20	496	0.69	51	1.14	720	4.45	1,276
TOTAL SUSPENDED PARTICULATE	60	15	200	11	2,181	183	148	951	3,749
TOTAL VOLATILE ORGANIC COMPOUNDS	274	113	5,299	32	3,195	358	8,476	204	17,950

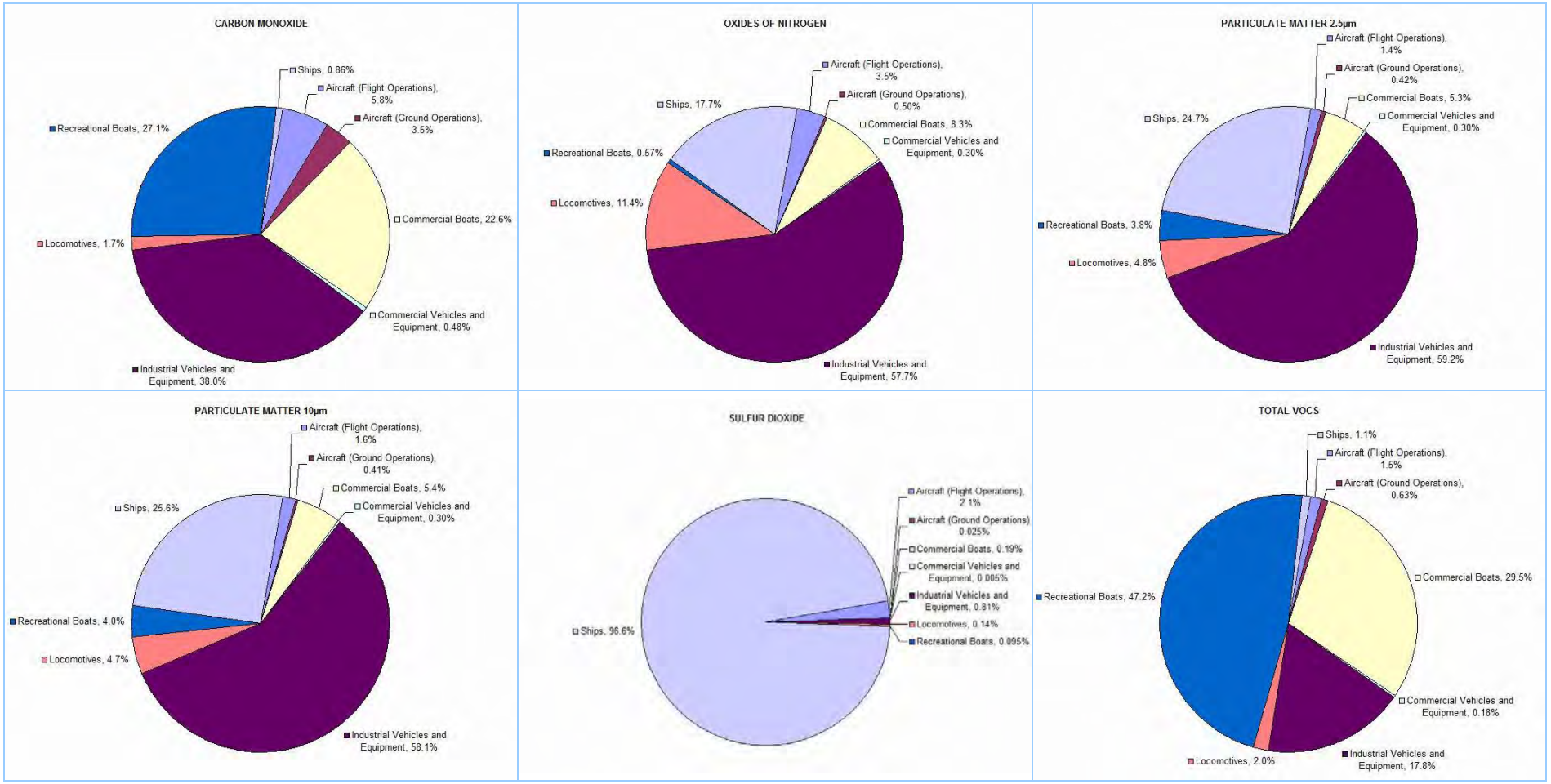

Figure ES-3: Proportions of total estimated annual emissions by off-road mobile source type in the GMR

Table ES-4: Total estimated annual emissions by off-road mobile source type in the Sydney region

Substance	Emissions (tonne/year)								
	Aircraft (flight operations)	Aircraft (ground operations)	Commercial boats	Commercial off-road vehicles and equipment	Industrial off-road vehicles and equipment	Locomotives	Recreational boats	Ships	Off-Road Mobile Total
1,3-BUTADIENE	3.54	0.12	5.14	2.93×10^{-2}	0.95	0.46	7.64	2.83×10^{-2}	18
ACETALDEHYDE	9.02	3.54	10	0.51	13	3.33	5.83	1.09	47
BENZENE	3.56	1.47	58	0.23	7.13	0.38	91	2.63	164
CARBON MONOXIDE	2,407	1,823	5,332	136	3,484	436	6,912	271	20,801
FORMALDEHYDE	26	7.89	21	1.57	37	7.02	9.51	2.30	113
ISOMERS OF XYLENE	0.94	0.72	227	0.17	5.84	0.83	365	1.34	602
LEAD & COMPOUNDS	1.07	4.41×10^{-4}	7.03×10^{-2}	2.19×10^{-4}	1.03×10^{-2}	9.65×10^{-3}	0.11	1.44×10^{-2}	1.28
OXIDES OF NITROGEN	1,771	255	3,319	84	2,600	2,927	143	5,138	16,238
PARTICULATE MATTER ≤ 10 µm	46	14	114	5.34	150	82	68	539	1,019
PARTICULATE MATTER ≤ 2.5 µm	41	14	108	5.18	146	80	62	496	952
PERCHLOROETHYLENE	-	-	-	3.0×10^{-5}	5.50×10^{-4}	-	-	-	5.80×10^{-4}
POLYCYCLIC AROMATIC HYDROCARBONS	2.46	1.46×10^{-2}	0.19	8.76×10^{-3}	0.23	0.22	0.16	1.73	5.02
SULFUR DIOXIDE	160	1.89	9.89	0.21	6.10	5.10	3.54	4,538	4,725
TOLUENE	1.33	1.09	209	0.21	7.02	0.55	341	2.55	563
TOTAL SUSPENDED PARTICULATE	47	15	118	5.55	156	88	70	556	1,056
TOTAL VOLATILE ORGANIC COMPOUNDS	253	99	2,296	15	372	172	4,016	117	7,341

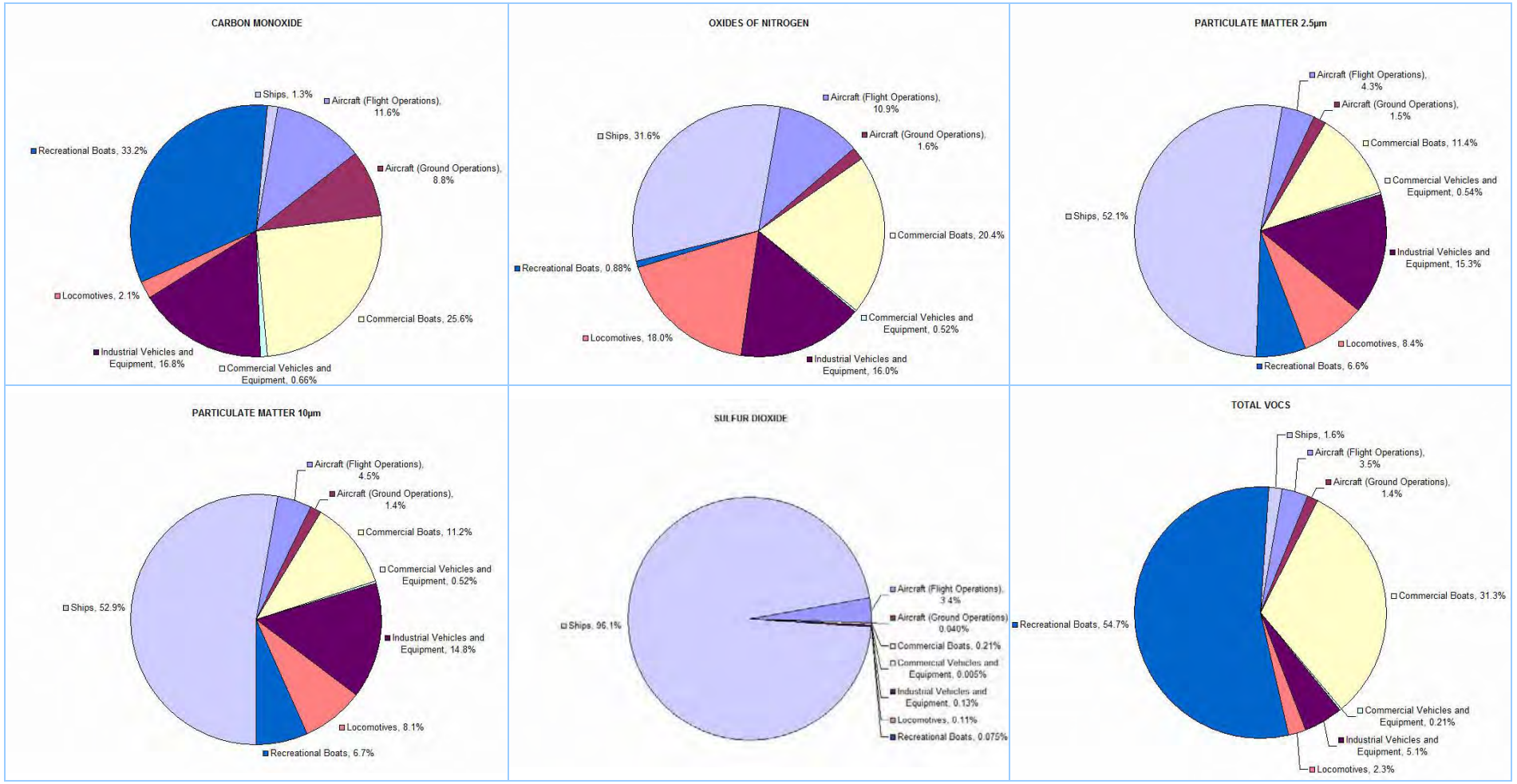

Figure ES-4: Proportions of total estimated annual emissions by off-road mobile source type in the Sydney region

Table ES-5: Total estimated annual emissions by off-road mobile source type in the Newcastle region

Substance	Emissions (tonne/year)								
	Aircraft (flight operations)	Aircraft (ground operations)	Commercial boats	Commercial off-road vehicles and equipment	Industrial off-road vehicles and equipment	Locomotives	Recreational boats	Ships	Off-Road Mobile Total
1,3-BUTADIENE	6.34×10^{-2}	4.10×10^{-3}	1.59	2.60×10^{-3}	0.27	4.77×10^{-2}	0.79	8.04×10^{-3}	2.78
ACETALDEHYDE	0.16	0.12	1.56	7.38×10^{-2}	6.79	0.35	0.61	0.31	9.97
BENZENE	6.37×10^{-2}	4.74×10^{-2}	18	2.42×10^{-2}	2.77	4.01×10^{-2}	9.49	0.79	31
CARBON MONOXIDE	41	60	1,566	18	816	46	717	79	3,343
FORMALDEHYDE	0.47	0.26	2.84	0.22	15	0.73	0.99	0.66	22
ISOMERS OF XYLENE	1.69×10^{-2}	2.37×10^{-2}	72	1.28×10^{-2}	1.59	8.63×10^{-2}	38	0.40	112
LEAD & COMPOUNDS	1.70×10^{-2}	1.45×10^{-5}	2.19×10^{-2}	2.45×10^{-5}	3.09×10^{-3}	1.01×10^{-3}	1.14×10^{-2}	4.09×10^{-3}	5.85×10^{-2}
OXIDES OF NITROGEN	32	8.42	227	12	1,305	306	15	1,643	3,548
PARTICULATE MATTER ≤ 10 µm	0.80	0.47	18	0.79	90	8.59	7.04	159	284
PARTICULATE MATTER ≤ 2.5 µm	0.71	0.46	17	0.77	87	8.33	6.48	146	266
PERCHLOROETHYLENE	-	-	-	3.88×10^{-6}	1.38×10^{-5}	-	-	-	1.77×10^{-5}
POLYCYCLIC AROMATIC HYDROCARBONS	4.36×10^{-2}	4.82×10^{-4}	4.17×10^{-2}	1.21×10^{-3}	9.60×10^{-2}	2.28×10^{-2}	1.68×10^{-2}	0.51	0.73
SULFUR DIOXIDE	2.88	6.25×10^{-2}	1.16	2.99×10^{-2}	2.68	0.53	0.37	1,292	1,300
TOLUENE	2.38×10^{-2}	3.52×10^{-2}	66	1.82×10^{-2}	2.16	5.75×10^{-2}	35	0.77	105
TOTAL SUSPENDED PARTICULATE	0.82	0.48	18	0.82	94	9.21	7.26	164	294
TOTAL VOLATILE ORGANIC COMPOUNDS	4.55	3.05	690	1.97	133	18	417	35	1,303

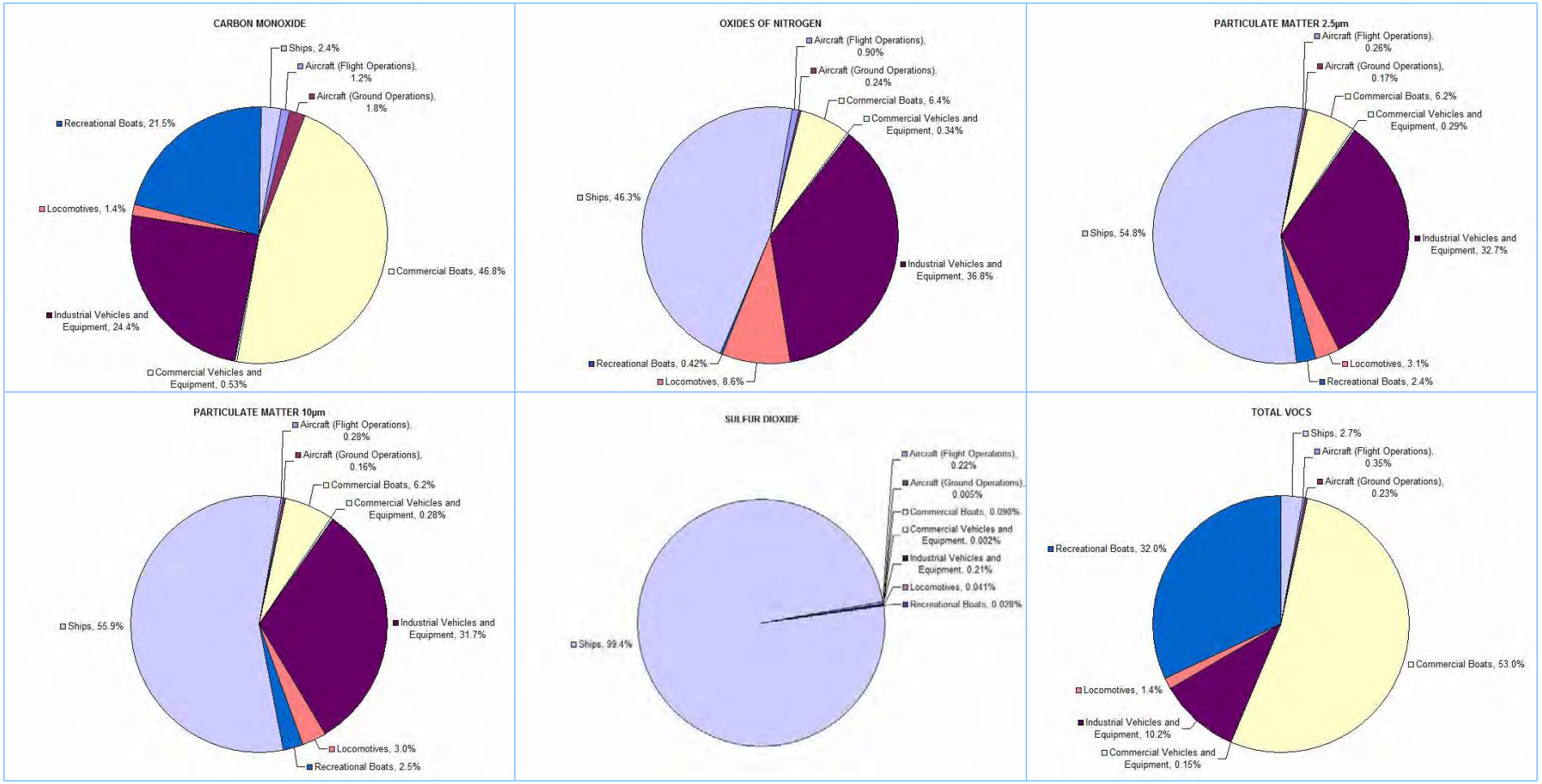

Figure ES-5: Proportions of total estimated annual emissions by off-road mobile source type in the Newcastle region

Table ES-6: Total estimated annual emissions by off-road mobile source type in the Wollongong region

Substance	Emissions (tonne/year)							
	Aircraft (flight operations)	Commercial boats	Commercial off-road vehicles and equipment	Industrial off-road vehicles and equipment	Locomotives	Recreational boats	Ships	Off-Road Mobile Total
1,3-BUTADIENE	4.53×10^{-3}	7.77×10^{-2}	4.33×10^{-4}	0.19	3.92×10^{-2}	0.84	3.77×10^{-3}	1.16
ACETALDEHYDE	1.22×10^{-2}	8.64×10^{-2}	1.23×10^{-2}	3.07	0.29	0.64	0.15	4.26
BENZENE	5.02×10^{-3}	0.87	4.65×10^{-3}	1.50	3.30×10^{-2}	10	0.35	13
CARBON MONOXIDE	13	77	1.38	770	37	762	37	1,698
FORMALDEHYDE	3.90×10^{-2}	0.16	2.83×10^{-2}	8.62	0.60	1.05	0.31	11
ISOMERS OF XYLENE	1.25×10^{-3}	3.53	2.43×10^{-3}	1.15	7.10×10^{-2}	40	0.18	45
LEAD & COMPOUNDS	1.22×10^{-2}	1.07×10^{-3}	4.84×10^{-6}	2.05×10^{-3}	8.30×10^{-4}	1.21×10^{-2}	1.75×10^{-3}	3.0×10^{-2}
OXIDES OF NITROGEN	0.57	16	1.85	607	252	16	706	1,598
PARTICULATE MATTER ≤ 10 µm	0.22	0.98	0.15	35	7.06	7.48	68	119
PARTICULATE MATTER ≤ 2.5 µm	0.15	0.91	0.15	34	6.85	6.89	62	112
PERCHLOROETHYLENE	-	-	6.91×10^{-8}	1.24×10^{-4}	-	-	-	1.24×10^{-4}
POLYCYCLIC AROMATIC HYDROCARBONS	5.43×10^{-3}	2.15×10^{-3}	1.67×10^{-4}	5.33×10^{-2}	1.87×10^{-2}	1.79×10^{-2}	0.22	0.31
SULFUR DIOXIDE	6.15×10^{-2}	6.87×10^{-2}	3.99×10^{-3}	1.41	0.44	0.39	551	553
TOLUENE	1.48×10^{-3}	3.23	3.43×10^{-3}	1.41	4.73×10^{-2}	38	0.34	43
TOTAL SUSPENDED PARTICULATE	0.22	1.01	0.16	37	7.58	7.72	70	123
TOTAL VOLATILE ORGANIC COMPOUNDS	0.26	34	0.24	83	15	443	16	591

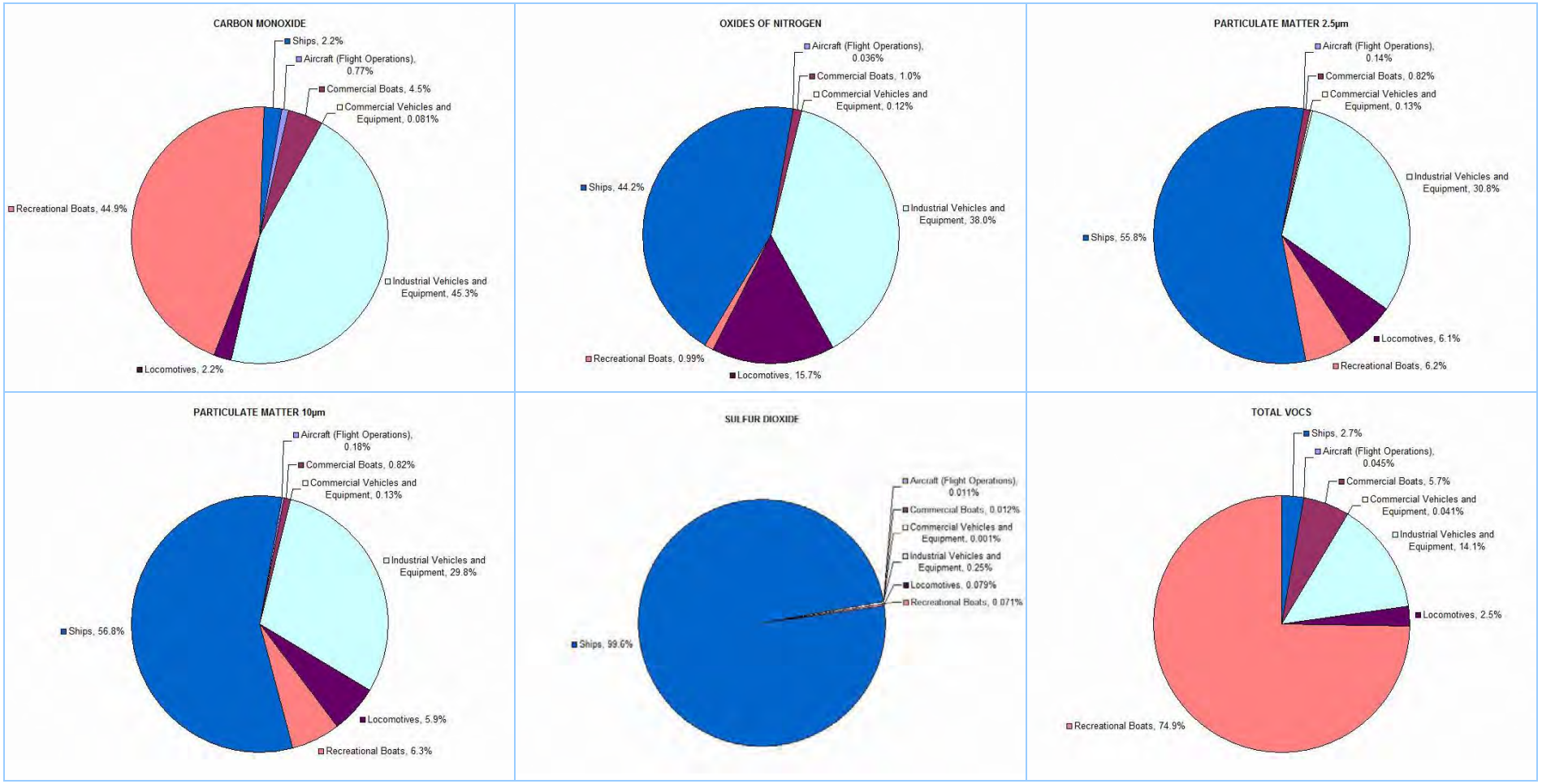

Figure ES-6: Proportions of total estimated annual emissions by off-road mobile source type in the Wollongong region

Table ES-7: Total estimated annual emissions by off-road mobile source type in the Non Urban region

Substance	Emissions (tonne/year)								
	Aircraft (flight operations)	Aircraft (ground operations)	Commercial boats	Commercial off-road vehicles and equipment	Industrial off-road vehicles and equipment	Locomotives	Recreational boats	Ships	Off-Road Mobile Total
1,3-BUTADIENE	0.26	7.79×10^{-4}	5.24	6.19×10^{-2}	5.06	0.41	6.84	7.05×10^{-3}	18
ACETALDEHYDE	0.69	2.22×10^{-2}	5.35	0.41	137	2.96	5.23	0.27	151
BENZENE	0.28	8.32×10^{-2}	58	0.40	54	0.34	82	0.82	196
CARBON MONOXIDE	667	11	5,178	100	15,361	387	6,194	76	27,975
FORMALDEHYDE	2.18	4.94×10^{-2}	9.79	1.18	305	6.24	8.52	0.58	333
ISOMERS OF XYLENE	7.09×10^{-2}	1.48×10^{-2}	239	0.41	29	0.73	327	0.42	596
LEAD & COMPOUNDS	0.61	2.76×10^{-6}	7.24×10^{-2}	3.66×10^{-4}	5.78×10^{-2}	8.58×10^{-3}	9.80×10^{-2}	3.67×10^{-3}	0.85
OXIDES OF NITROGEN	46	1.60	843	64	26,204	2,602	128	1,938	31,826
PARTICULATE MATTER ≤ 10 µm	11	8.84×10^{-2}	61	4.42	1,818	73	61	157	2,185
PARTICULATE MATTER ≤ 2.5 µm	7.87	8.68×10^{-2}	57	4.29	1,764	71	56	145	2,104
PERCHLOROETHYLENE	-	-	-	1.56×10^{-5}	5.23×10^{-5}	-	-	-	6.80×10^{-5}
POLYCYCLIC AROMATIC HYDROCARBONS	0.29	9.15×10^{-5}	0.14	7.19×10^{-3}	1.90	0.19	0.15	0.50	3.18
SULFUR DIOXIDE	4.62	1.19×10^{-2}	4.07	0.16	53	4.54	3.17	1,176	1,246
TOLUENE	8.61×10^{-2}	7.05×10^{-2}	218	0.46	41	0.49	306	0.79	566
TOTAL SUSPENDED PARTICULATE	11	9.21×10^{-2}	63	4.60	1,894	78	63	162	2,276
TOTAL VOLATILE ORGANIC COMPOUNDS	16	11	2,279	15	2,607	153	3,599	36	8,715

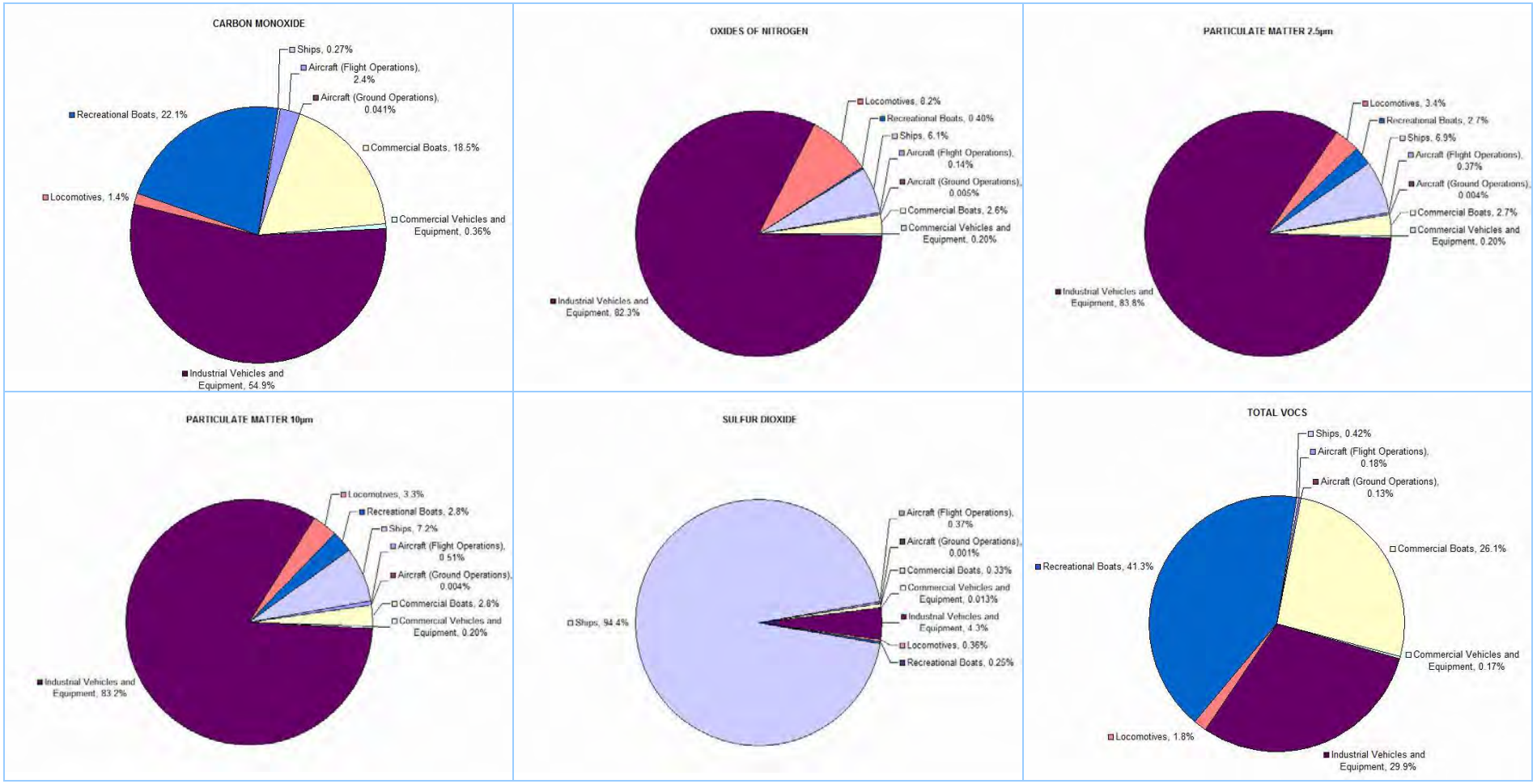

Figure ES-7: Proportions of total estimated annual emissions by off-road mobile source type in the Non Urban region

Table ES-8 presents total estimated fuel consumption from all off-road mobile sources in the GMR by volume and energy content.

Table ES-8: Total estimated annual fuel consumption from off-road mobile sources by volume and energy content in the GMR

Fuel	Annual fuel consumption	
	Volume (kL/year)	Energy content (TJ/year)
2-Stroke petrol	63,776	2,181
4-Stroke petrol	17,090	584
Avgas	2,009	66
Avtur	178,129	6,555
Diesel	1,014,171	39,147
LPG	21,780	555
Marine diesel oil	18,589	706
Marine gas oil	3,053	111
Residual oil	145,424	5,748
Grand Total	1,464,021	55,655

Figure ES-8 and Figure ES-9 show total estimated fuel consumption from all off-road mobile sources in the GMR by volume and energy content, respectively.

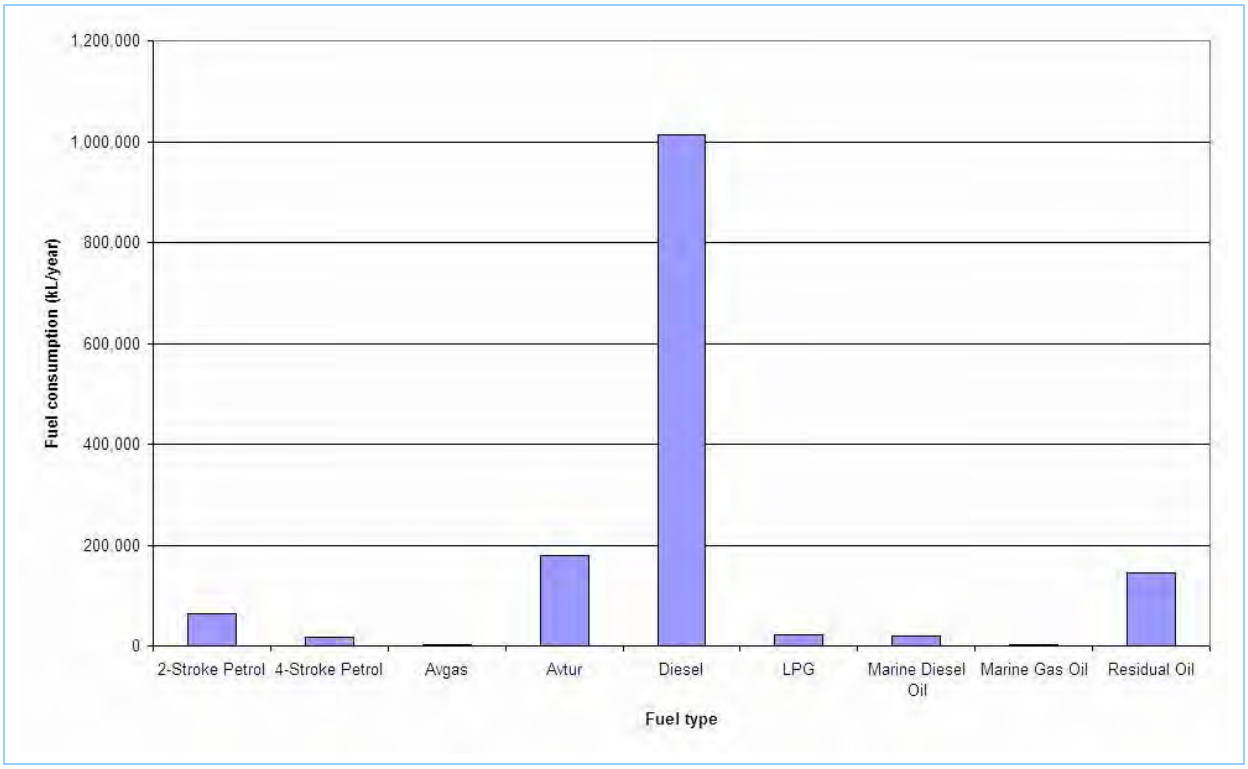

Figure ES-8: Total estimated annual fuel consumption from off-road mobile sources by volume in the GMR

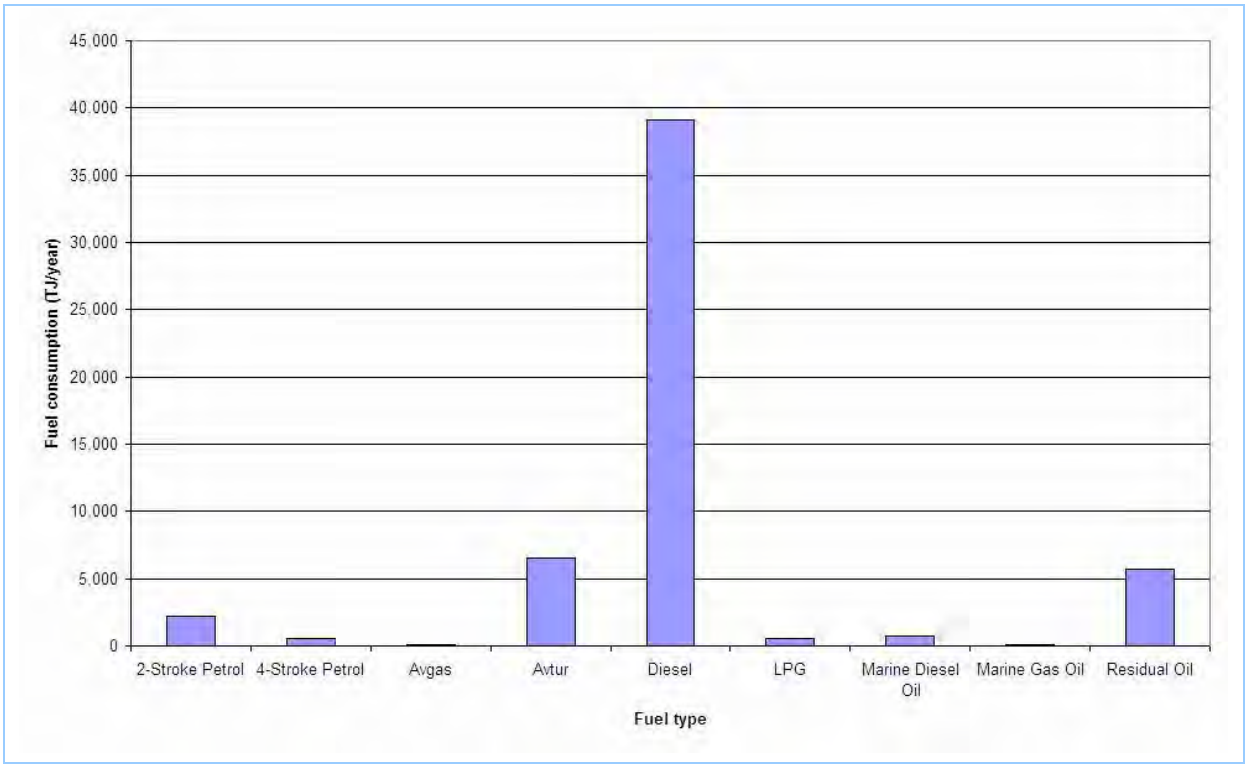

Figure ES-9: Total estimated annual fuel consumption from off-road mobile sources by energy content in the GMR

Table ES-9 and Table ES-10 present total estimated fuel consumption by off-road mobile source type in the GMR by volume and energy content, respectively.

Figure ES-10 and Figure ES-11 show total estimated fuel consumption by off-road mobile source type in the GMR by volume and energy content, respectively.

Table ES-9: Total estimated annual fuel consumption by off-road mobile source type and volume in the GMR

Source type	Volume (kL/year)									
	2-Stroke petrol	4-Stroke petrol	Avgas	Avtur	Diesel	LPG	Marine diesel oil	Marine gas oil	Residual oil	Grand Total
Aircraft ground operations – diesel	-	-	-	-	23,858	-	-	-	-	23,858
Aircraft flight operations – avgas	-	-	2,009	-	-	-	-	-	-	2,009
Aircraft flight operations – avtur	-	-	-	178,129	-	-	-	-	-	178,129
Commercial boats – diesel	-	-	-	-	120,180	-	-	-	-	120,180
Commercial boats - petrol 2 stroke	25,501	-	-	-	-	-	-	-	-	25,501
Commercial boats - petrol 4 stroke	-	7,070	-	-	-	-	-	-	-	7,070
Commercial vehicles and equipment – diesel	-	-	-	-	3,128	-	-	-	-	3,128
Commercial vehicles and equipment – gas	-	-	-	-	-	1,332	-	-	-	1,332
Commercial vehicles and equipment – petrol	-	57	-	-	-	-	-	-	-	57
Industrial vehicles and equipment – diesel	-	-	-	-	737,337	-	-	-	-	737,337
Industrial vehicles and equipment – gas	-	-	-	-	-	20,448	-	-	-	20,448
Industrial vehicles and equipment – petrol	-	2,092	-	-	-	-	-	-	-	2,092
Locomotives – line haul	-	-	-	-	114,170	-	-	-	-	114,170
Locomotives – passenger	-	-	-	-	14,666	-	-	-	-	14,666
Recreational boats – diesel	-	-	-	-	831	-	-	-	-	831
Recreational boats – petrol 2 stroke	38,275	-	-	-	-	-	-	-	-	38,275
Recreational boats – petrol 4 stroke	-	7,871	-	-	-	-	-	-	-	7,871
Ships auxiliary boiler – diesel oil	-	-	-	-	-	-	5,881	-	-	5,881
Ships auxiliary boiler – gas oil	-	-	-	-	-	-	-	843	-	843
Ships auxiliary boiler – residual oil	-	-	-	-	-	-	-	-	37,264	37,264
Ships auxiliary engine – diesel oil	-	-	-	-	-	-	6,396	-	-	6,396
Ships auxiliary engine – gas oil	-	-	-	-	-	-	-	845	-	845
Ships auxiliary engine – residual oil	-	-	-	-	-	-	-	-	37,921	37,921
Ships main engine – diesel oil	-	-	-	-	-	-	6,313	-	-	6,313
Ships main engine – gas oil	-	-	-	-	-	-	-	1,365	-	1,365
Ships main engine – residual oil	-	-	-	-	-	-	-	-	70,239	70,239
Grand Total	63,776	17,090	2,009	178,129	1,014,171	21,780	18,589	3,053	145,424	1,464,021

Table ES-10: Total estimated annual fuel consumption by off-road mobile source type and energy content in the GMR

Source type	Energy content (TJ/year)									
	2-Stroke petrol	4-Stroke petrol	Avgas	Avtur	Diesel	LPG	Marine diesel oil	Marine gas oil	Residual oil	Grand Total
Aircraft ground operations – diesel	-	-	-	-	921	-	-	-	-	921
Aircraft flight operations – avgas	-	-	66	-	-	-	-	-	-	66
Aircraft flight operations – avtur	-	-	-	6,555	-	-	-	-	-	6,555
Commercial boats – diesel	-	-	-	-	4,639	-	-	-	-	4,639
Commercial boats – petrol 2 stroke	872	-	-	-	-	-	-	-	-	872
Commercial boats – petrol 4 stroke	-	242	-	-	-	-	-	-	-	242
Commercial vehicles and equipment – diesel	-	-	-	-	121	-	-	-	-	121
Commercial vehicles and equipment – gas	-	-	-	-	-	34	-	-	-	34
Commercial vehicles and equipment – petrol	-	2	-	-	-	-	-	-	-	2
Industrial vehicles and equipment – diesel	-	-	-	-	28,461	-	-	-	-	28,461
Industrial vehicles and equipment – gas	-	-	-	-	-	521	-	-	-	521
Industrial vehicles and equipment – petrol	-	72	-	-	-	-	-	-	-	72
Locomotives – line haul	-	-	-	-	4,407	-	-	-	-	4,407
Locomotives – passenger	-	-	-	-	566	-	-	-	-	566
Recreational boats – diesel	-	-	-	-	32	-	-	-	-	32
Recreational boats – petrol 2 stroke	1,309	-	-	-	-	-	-	-	-	1,309
Recreational boats – petrol 4 stroke	-	269	-	-	-	-	-	-	-	269
Ships auxiliary boiler – diesel oil	-	-	-	-	-	-	223	-	-	223
Ships auxiliary boiler – gas oil	-	-	-	-	-	-	-	31	-	31
Ships auxiliary boiler – residual oil	-	-	-	-	-	-	-	-	1,473	1,473
Ships auxiliary engine – diesel oil	-	-	-	-	-	-	243	-	-	243
Ships auxiliary engine – gas oil	-	-	-	-	-	-	-	31	-	31
Ships auxiliary engine – residual oil	-	-	-	-	-	-	-	-	1,499	1,499
Ships main engine – diesel oil	-	-	-	-	-	-	240	-	-	240
Ships main engine – gas oil	-	-	-	-	-	-	-	50	-	50
Ships main engine – residual oil	-	-	-	-	-	-	-	-	2,776	2,776
Grand Total	2,181	584	66	6,555	39,147	555	706	111	5,748	55,655

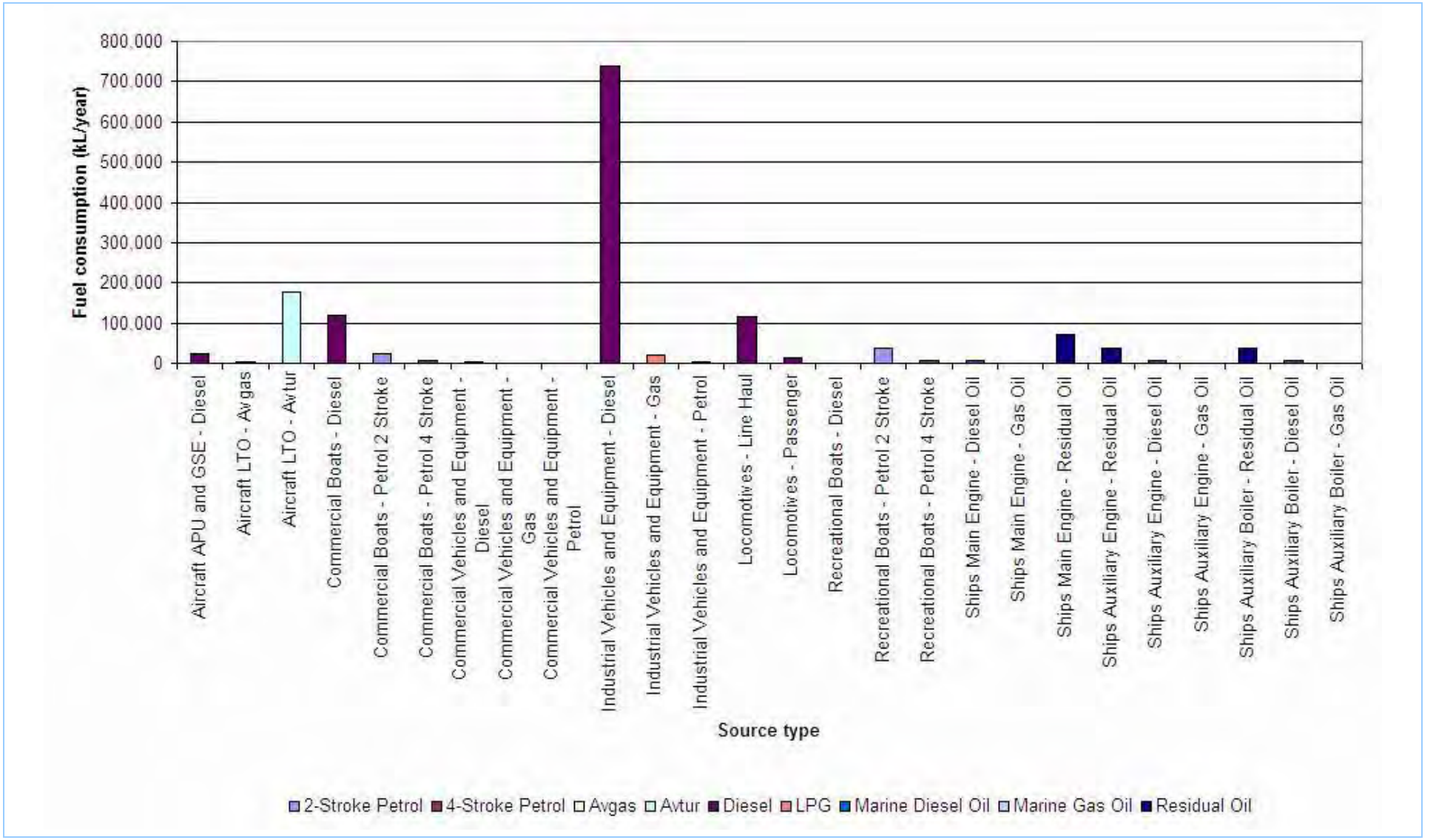

Figure ES-10: Total estimated annual fuel consumption by off-road mobile source type and volume in the GMR

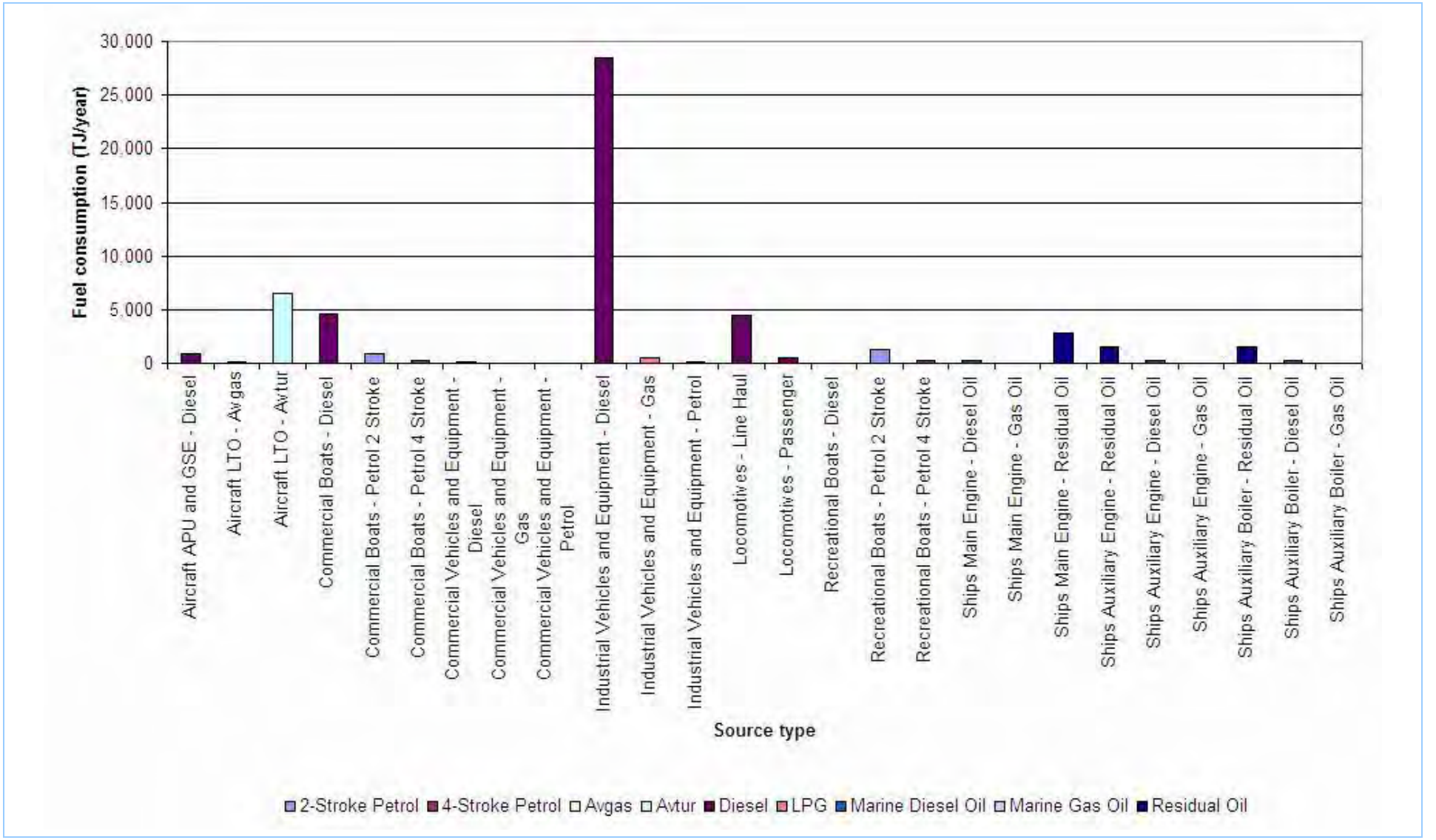

Figure ES-11: Total estimated annual fuel consumption by off-road mobile source type and energy content in the GMR