

Supplementary file for:

## Road transport vehicles in South Africa towards 2050: Factors influencing technology choice and implications for fuel supply

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Table 1: Freight Road Vehicle Types in SATIM.

Freight Vehicle	Weight Class [kg]	Model ID
Light commercial vehicle	<3,000	LCV
Medium commercial vehicle	3,000 -7,500	HCV1
Heavy commercial vehicle	7,501 – 12,000	HCV2
Heavy commercial vehicle	12,001 – 16,000	HCV3
Heavy commercial vehicle	16,001 – 20,000	HCV4
Heavy commercial vehicle	20,001 – 24,000	HCV5
Heavy commercial vehicle	24,001 – 32,000	HCV6
Extra heavy commercial vehicle	32,001 – 40,000	HCV7
Extra Heavy commercial vehicle	40,001 – 50,000	HCV8
Extra heavy commercial vehicle	>50,000	HCV9

Table 2: Disaggregated Demand for Freight in SATIM.

tkm Freight Class	Reference					EMS				
	2010	2020	2030	2040	2050	2010	2020	2030	2040	2050
LCV	19	23	29	34	42	19	23	29	34	42
HCV1	5	7	8	10	12	5	6	7	8	10
HCV2	2	2	3	4	4	2	2	3	3	4
HCV3	14	17	21	25	30	14	16	19	21	25
HCV4	5	7	8	10	12	5	6	7	8	10
HCV5	3	4	5	6	7	3	4	5	5	6
HCV6	77	94	116	138	168	77	89	105	118	137
HCV7	27	33	41	49	60	27	31	37	42	48
HCV8	0	0	0	1	1	0	0	0	0	1
HCV9	1	1	1	2	2	1	1	1	2	2
Corridor Rail	29	35	44	52	63	29	43	63	85	116
Other Rail	27	33	40	48	59	27	33	41	49	61
Export Rail (bulk mining)	65	73	100	136	195	65	73	100	136	195
<b>Total</b>	<b>276</b>	<b>328</b>	<b>418</b>	<b>512</b>	<b>655</b>	<b>276</b>	<b>328</b>	<b>418</b>	<b>512</b>	<b>655</b>

Table 3: Comparative Vehicle Costs and Efficiencies (AEA, 2012).

Vehicle Type	2010	2020	2030	2040	2050	2010	2020	2030	2040	2050
<b>Passenger Car</b>	<b>Capital Cost</b>					<b>Net MJ/km (Real World Overall Vehicle)</b>				
Petrol ICE	R 172,590	R 186,888	R 193,254	R 197,489	R 199,958	2.77	2.07	1.69	1.51	1.38
Diesel ICE	1.03	1.05	1.04	1.04	1.04	2.23	1.75	1.46	1.30	1.20
Petrol HEV	1.23	1.08	1.03	1.01	1.00	2.12	1.69	1.45	1.32	1.21
Diesel HEV	1.23	1.11	1.06	1.04	1.03	1.77	1.49	1.30	1.20	1.09
Petrol PHEV	1.64	1.23	1.12	1.09	1.06	1.68	1.27	1.13	1.06	1.00
Diesel PHEV	1.66	1.27	1.15	1.12	1.10	1.44	1.15	1.05	0.99	0.94
Petrol REEV	2.21	1.41	1.20	1.16	1.13	1.24	1.06	0.95	0.89	0.84
Diesel REEV	2.21	1.43	1.22	1.18	1.15	1.11	0.98	0.89	0.84	0.80
BEV	2.57	1.61	1.29	1.28	1.27	0.69	0.63	0.58	0.55	0.52
H2FC	7.76	2.83	1.44	1.26	1.21	1.08	0.94	0.84	0.77	0.71
H2FC PHEV	8.22	3.00	1.55	1.35	1.29	0.96	0.81	0.72	0.68	0.63
H2FC REEV	5.66	2.30	1.40	1.27	1.21	0.84	0.75	0.68	0.63	0.59
NG ICE	1.08	1.05	1.04	1.03	1.03	2.77	2.07	1.69	1.51	1.38
<b>Van / LCV</b>										
Petrol ICE	R 138,315	R 150,358	R 155,899	R 162,709	R 166,120	2.85	2.33	2.06	1.83	1.67
Diesel ICE	1.07	1.08	1.08	1.08	1.08	2.90	2.49	2.20	1.96	1.80
Petrol HEV	1.22	1.09	1.04	1.02	1.00	2.17	1.85	1.69	1.53	1.39
Diesel HEV	1.29	1.17	1.11	1.09	1.07	2.43	2.16	1.97	1.80	1.64
Petrol PHEV	1.53	1.22	1.11	1.07	1.05	1.73	1.36	1.28	1.20	1.13
Diesel PHEV	1.59	1.29	1.18	1.14	1.12	1.90	1.55	1.46	1.38	1.31
Petrol REEV	1.93	1.36	1.19	1.13	1.10	1.28	1.13	1.06	1.00	0.94
Diesel REEV	1.99	1.42	1.24	1.19	1.15	1.37	1.25	1.18	1.12	1.06
BEV	2.68	1.68	1.36	1.33	1.32	0.71	0.66	0.62	0.59	0.56
H2FC	7.91	2.91	1.50	1.30	1.24	1.40	1.25	1.14	1.05	0.97
H2FC PHEV	8.24	3.05	1.59	1.38	1.31	1.19	1.00	0.92	0.85	0.79
H2FC REEV	5.65	2.35	1.44	1.29	1.23	0.97	0.88	0.82	0.77	0.71
NG ICE	1.17	1.13	1.11	1.10	1.09	3.34	2.73	2.42	2.15	1.96
<b>Small Rigid Truck</b>										
Diesel ICE	R 358,709	R 431,630	R 458,943	R 483,403	R 499,463	9.38	8.86	8.17	7.66	7.37
Diesel FHV	1.22	1.13	1.08	1.06	1.04	8.04	8.07	7.43	6.97	6.70
Diesel HHV	1.24	1.08	1.06	1.05	1.04	8.51	8.55	7.81	7.26	6.98
Diesel HEV	1.27	1.11	1.05	1.01	0.99	7.56	7.61	7.01	6.64	6.33
BEV	3.35	1.83	1.40	1.35	1.32	2.87	2.78	2.62	2.48	2.34
H2FC	6.37	2.27	1.23	1.06	0.99	4.42	4.14	3.79	3.47	3.19
DNG ICE	1.58	1.29	1.22	1.18	1.16	9.38	8.86	8.17	7.66	7.37
NG ICE	1.51	1.24	1.17	1.14	1.12	10.79	10.19	9.39	8.81	8.47
<b>Large Rigid Truck</b>										
Diesel ICE	R 587,364	R 708,864	R 754,714	R 784,142	R 809,480	12.41	11.08	9.27	8.55	8.04
Diesel FHV	1.15	1.09	1.05	1.04	1.03	11.59	10.67	8.93	8.23	7.73
Diesel HHV	1.12	1.04	1.02	1.03	1.02	11.91	10.88	9.03	8.18	7.69
Diesel HEV	1.26	1.11	1.06	1.03	1.01	11.28	10.25	8.49	7.69	7.17
BEV										
H2FC	6.10	2.19	1.20	1.05	0.98	5.88	5.14	4.39	3.86	3.51
DNG ICE	1.43	1.21	1.15	1.12	1.11	12.41	11.08	9.27	8.55	8.04
NG ICE	1.36	1.15	1.10	1.07	1.06	14.27	12.74	10.66	9.83	9.24
<b>Articulated Truck</b>										
Diesel ICE	R 751,660	R 932,127	R 980,313	R 1,017,921	R 1,041,286	13.99	11.82	9.41	8.51	7.91
Diesel FHV	1.16	1.09	1.05	1.03	1.02	13.44	11.5	9.24	8.42	7.84
Diesel HHV	1.18	1.06	1.04	1.03	1.02	13.67	11.61	9.26	8.37	7.8
Diesel HEV	1.28	1.10	1.05	1.03	1.01	13.15	11.27	8.93	8.05	7.4
BEV										
H2FC	6.69	2.26	1.22	1.06	0.99	6.64	5.62	4.7	4.18	3.77
DNG ICE	1.47	1.22	1.16	1.13	1.11	13.99	11.82	9.41	8.51	7.91
NG ICE	1.39	1.16	1.10	1.07	1.06	16.08	13.6	10.82	9.79	9.1
<b>Construction Truck</b>										
Diesel ICE	R 612,915	R 745,629	R 786,726	R 820,088	R 850,818	13.16	12.08	11.08	10.4	9.89
Diesel FHV	1.18	1.12	1.08	1.06	1.04	12.46	11.69	10.73	10.08	9.59
Diesel HHV	1.18	1.08	1.05	1.07	1.10	12.73	11.9	10.88	9.99	9.23
Diesel HEV	1.24	1.09	1.04	1.04	1.07	12.16	11.39	10.37	9.51	8.73
BEV										
H2FC	5.59	2.05	1.17	1.06	1.04	6.24	5.46	4.97	4.43	3.97
DNG ICE	1.49	1.25	1.19	1.16	1.14	13.16	12.08	11.08	10.4	9.89
NG ICE	1.43	1.20	1.15	1.12	1.10	15.13	13.9	12.75	11.95	11.38
<b>Bus</b>										
Diesel ICE	R 1,279,538	R 1,383,425	R 1,435,086	R 1,468,301	R 1,506,219	13.99	13.19	11.73	11.22	10.79
Diesel FHV	1.08	1.06	1.04	1.03	1.02	11.31	11.05	9.87	9.43	9.07
Diesel HHV	1.08	1.04	1.03	1.02	1.01	12.02	11.74	10.49	10.02	9.64
Diesel HEV	1.11	1.06	1.03	1.01	1.00	9.9	9.74	8.85	8.49	8.1
BEV	2.01	1.42	1.22	1.21	1.20	4.3	4.15	3.94	3.76	3.57
H2FC	2.65	1.44	1.08	1.03	1.00	6.63	6.2	5.69	5.27	4.87
DNG ICE	1.14	1.08	1.06	1.05	1.05	13.99	13.19	11.73	11.22	10.79
NG ICE	1.11	1.06	1.04	1.04	1.03	16.09	15.17	13.5	12.9	12.41

Table 4: Vehicle Mileage Decay Rates (Merven et al., 2012).

Vehicle Type	Decay Rate	Vehicle Life (Years)				
		0	5	10	30	50
HCV1Diesel	0.05	50000	39049	23818	5404	456
HCV1Petrol	0.09	50000	32073	13197	919	11
HCV2Diesel	0.10	50000	30668	11538	614	5
HCV3Diesel	0.05	85000	65382	38685	8013	581
HCV4Diesel	0.05	85000	65382	38685	8013	581
HCV5Diesel	0.08	110000	74238	33814	3195	63
HCV6Diesel	0.08	110000	74238	33814	3195	63
HCV7Diesel	0.09	150000	94579	37601	2363	23
HCV8Diesel	0.09	150000	94579	37601	2363	23
HCV9Diesel	0.08	150000	101275	46166	4373	86
LCVDiesel	0.08	35000	23631	10772	1020	20
LCVGasoline	0.04	28000	22924	15367	4628	626
CarGasoline	0.04	21000	17193	11525	3471	470
MotoGasoline	0.04	10000	8187	5488	1653	224
SUVGasoline	0.04	24000	19650	13171	3967	537
BusDiesel	0.04	40000	32749	21952	6612	895
BRTDiesel	0.04	40000	32749	21952	6612	895
MBTDiesel	0.04	40000	32749	21952	6612	895

Table 5: SATIM Results: Fuel Commodity Costs.

Base Year	Fuels (R/GJ)															
	Diesel	137	Petrol	127	Gas	140	Electricity Utility (R/kWh)					0.57				
	2030							2045								
Scenario Name	CO <sub>2</sub> (R/ton)	Diesel	Petrol	E85	Gas	H <sub>2</sub>	Electricity Utility	Electricity Utility (R/kWh)	CO <sub>2</sub> (R/ton)	Diesel	Petrol	E85	Gas	H <sub>2</sub>	Electricity Utility	Electricity Utility (R/kWh)
Reference	100	243	201	201	205	265	203	0.73	300	308	240	274	201	334	242	0.87
RefTech2020	90	251	189	189	204	262	203	0.73	280	307	238	269	200	328	244	0.88
Ref-LoOil	80	185	187	311	204	248	206	0.74	260	202	163	284	198	324	242	0.87
RefHiTech	150	243	248	255	208	283	203	0.73	470	284	310	277	261	374	242	0.87
RefHiTech_LoOil	130	189	198	255	207	257	203	0.73	420	185	224	259	257	363	236	0.85
RefHiTech-UCE	0	234	237	237	199	264	200	0.72	0	251	280	276	221	263	236	0.85
RefTech2020-UCE	0	245	181	182	199	251	203	0.73	0	282	219	228	182	263	239	0.86
Ref-UCE	0	233	207	285	199	255	200	0.72	0	282	219	228	182	263	239	0.86
Ref10Gt	480	267	273	270	228	364	222	0.8	1530	287	312	238	277	522	306	1.1
eMode	40	248	186	195	201	256	206	0.74	130	300	215	256	191	294	239	0.86
eModeLoOil	30	187	145	196	201	234	203	0.73	100	194	142	251	188	286	236	0.85
eModeHiTech	90	251	191	255	204	262	203	0.73	270	292	256	258	244	327	236	0.85
eMode10Gt	440	264	262	268	226	359	219	0.79	1410	291	295	295	269	506	306	1.1