

SUPPLEMENTARY MATERIAL FOR

Aging passenger car fleet structure, dynamics and environmental performance evaluation at regional level by life cycle assessment

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Table S1. Passenger car use inventory – urban scenario, hot emission, off peak operation

Pollution class	Unit	Petrol engines							Diesel engines						
		NON EURO	EURO 1	EURO 2	EURO 3	EURO 4	EURO 5	EURO 6	NON EURO	EURO 1	EURO 2	EURO 3	EURO 4	EURO 5	EURO 6
INPUTS															
Energy consumption	MJ/km	4.4575	2.9178	3.1047	3.0190	3.2274	3.2274	3.2274	3.5841	2.8508	3.0493	2.7771	2.7771	2.7771	2.7771
Fuel consumption	kg/km	0.1042	0.0682	0.0726	0.0706	0.0755	0.0755	0.0755	0.1044	0.0683	0.0727	0.0707	0.0756	0.0756	0.0756
OUTPUTS															
Carbon monoxide	g/km	41.2378	2.8782	1.0235	0.4814	0.1591	0.2497	0.2383	0.9393	0.6383	0.5656	0.1767	0.1900	0.0569	0.0221
Carbon Dioxide	g/km	321.79	210.64	224.13	217.94	232.99	232.99	232.99	266.48	211.96	226.72	206.48	206.48	206.48	206.48
Methane	g/km	0.0929	0.0184	0.0121	0.0021	0.0020	0.0020	0.0020	0.0199	0.0078	0.0050	0.0021	0.0008	0.0001	0.0001
Sulfur Dioxide	g/km	0.0020	0.0013	0.0014	0.0013	0.0014	0.0014	0.0014	0.0016	0.0012	0.0013	0.0012	0.0012	0.0012	0.0012
NOx	g/km	1.4297	0.3399	0.2058	0.0826	0.0789	0.0401	0.0401	0.6963	0.9043	0.9865	0.9232	0.7785	0.7324	0.0644
NO ₂	g/km	0.0572	0.0136	0.0082	0.0025	0.0024	0.0012	0.0008	0.0766	0.0995	0.1085	0.2308	0.4282	0.2929	0.0129
NO	g/km	1.3725	0.3263	0.1976	0.0801	0.0765	0.0389	0.0393	0.6197	0.8048	0.8780	0.6924	0.3503	0.4394	0.0515
Dinitrous Oxide	g/km	0.0071	0.0185	0.0092	0.0012	0.0015	0.0018	0.0018	0.0000	0.0014	0.0028	0.0064	0.0064	0.0064	0.0078
Particulates, PM 2.5	g/km	0.0008	0.0004	0.0001	0.0005	0.0004	0.0007	0.0003	0.2726	0.0689	0.0562	0.0366	0.0360	0.0001	0.0001
Lead	mg/km	0.000166	0.000109	0.000116	0.000112	0.000120	0.000120	0.000120	0.000042	0.000034	0.000036	0.000033	0.000033	0.000033	0.000033
Nickel	mg/km	0.000239	0.000156	0.000166	0.000162	0.000173	0.000173	0.000173	0.000017	0.000013	0.000014	0.000013	0.000013	0.000013	0.000013
Zinc	mg/km	0.003422	0.002240	0.002384	0.002318	0.002478	0.002478	0.002478	0.001525	0.001213	0.001298	0.001182	0.001182	0.001182	0.001182
Selenium	mg/km	0.000021	0.000014	0.000014	0.000014	0.000015	0.000015	0.000015	0.000008	0.000007	0.000007	0.000007	0.000007	0.000007	0.000007
Mercury	mg/km	0.000902	0.000591	0.000628	0.000611	0.000653	0.000653	0.000653	0.000449	0.000357	0.000382	0.000348	0.000348	0.000348	0.000348
Chromium	mg/km	0.000653	0.000428	0.000455	0.000442	0.000473	0.000473	0.000473	0.000720	0.000573	0.000613	0.000558	0.000558	0.000558	0.000558
Arsenic	mg/km	0.000031	0.000020	0.000022	0.000021	0.000023	0.000023	0.000023	0.000008	0.000007	0.000007	0.000007	0.000007	0.000007	0.000007
Cadmium	mg/km	0.000021	0.000014	0.000014	0.000014	0.000015	0.000015	0.000015	0.000004	0.000003	0.000004	0.000003	0.000003	0.000003	0.000003
VOCs	g/km	3.7487	0.2959	0.1309	0.0238	0.0115	0.0079	0.0079	0.2838	0.0838	0.0590	0.0323	0.0250	0.0017	0.0016
NMVOCS	g/km	3.6558	0.2775	0.1189	0.0217	0.0094	0.0059	0.0059	0.2640	0.0760	0.0541	0.0302	0.0242	0.0016	0.0015

Table S2. Iasi County Passenger car fleet evolution

Year	Romania*		Iasi*		EU27**	
	No.	Change, %	Cars/1000 ppl	no.	Change, %	Cars/1000 ppl
2006	3,220,682	-	152	71,596	-	88
2007	3,554,404	10.36%	172	79,877	11.57%	99
2008	4,027,367	13.31%	197	91,365	14.38%	114
2009	4,244,922	5.40%	209	100,148	9.61%	126
2010	4,319,701	1.76%	214	106,086	5.93%	135
2011	4,334,547	0.34%	216	111,118	4.74%	117
2012	4,487,251	3.52%	224	117,850	6.06%	152
2013	4,695,660	4.64%	235	124,985	6.05%	161
2014	4,907,564	4.51%	247	132,451	5.97%	169
2015	5,155,059	5.04%	261	140,898	6.38%	179
2016	5,472,423	6.16%	279	151,032	7.19%	192
2017	5,998,194	9.61%	307	164,595	8.98%	208
2018	6,452,536	7.57%	332	179,494	9.05%	227
2019	6,902,984	6.98%	357	193,205	7.64%	243
2020	7,274,728	5.39%	376	205,554	6.69%	260
					no data	no data

Notes: *% refer to change compared to the previous year; ppl- people

Table S3. Iasi county car fleet age dynamics

	Total	0—2 years		3 - 5 years		6—10 years		11—15 years		16—20 years		>20	
Years		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
2017	164,576	3952	2.4	5852	3.6	28,012	17.0	54,961	33.4	404,39	24.6%	31,360	19.1
2018	179,475	5165	2.9	7189	4.0	23,217	12.9	62,354	34.7	46,827	26.1%	34,723	19.3
2019	193,187	7027	3.6	8459	4.4	23,236	12.0	62,669	32.4	53,277	27.6%	385,19	19.9
2020	205,554	10,179	5.0	9863	4.8	26,431	12.9	66,848	32.5	53,565	26.1%	38,668	18.8
2021	218,315	5663	2.6	11943	5.5	24,343	11.2	55,419	25.4	64,291	29.4%	56,656	26.0

*% represents share of the total

Table S4. Iasi County passenger cars distribution by type of fuel

Years	Total	Petrol		Diesel		Hybrid		Electric	
2015	140,878	92,161	65.40%	48,523	34.4%	194	0.10%	0	0
2016	151,013	95,540	63.30%	55,187	36.5%	284	0.20%	2	0.00%
2017	164,576	98,675	60.00%	65,491	39.8%	401	0.20%	9	0.01%
2018	179,475	101,654	56.60%	77,199	43.0%	602	0.30%	20	0.01%
2019	193,187	104,570	54.10%	87,592	45.3%	965	0.50%	60	0.03%
2020	205,554	106,567	51.80%	97,257	47.3%	1,576	0.80%	154	0.07%
2021	217,280	107,569	49.50%	106,501	49.0%	2,792	1.30%	418	0.19%

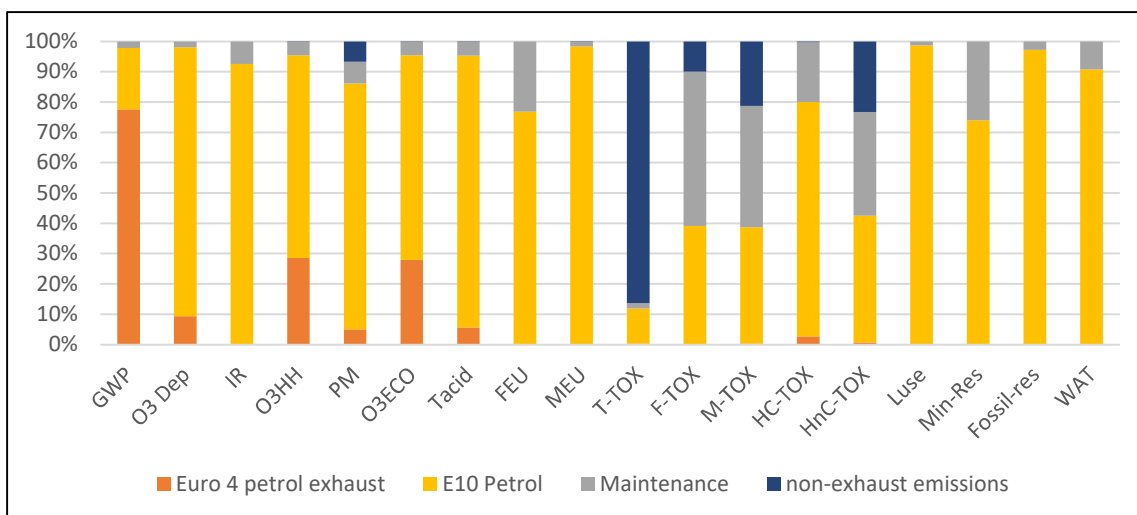


Figure S1. Environmental profile of a 1 km urban drive of a EURO 4 petrol passenger car

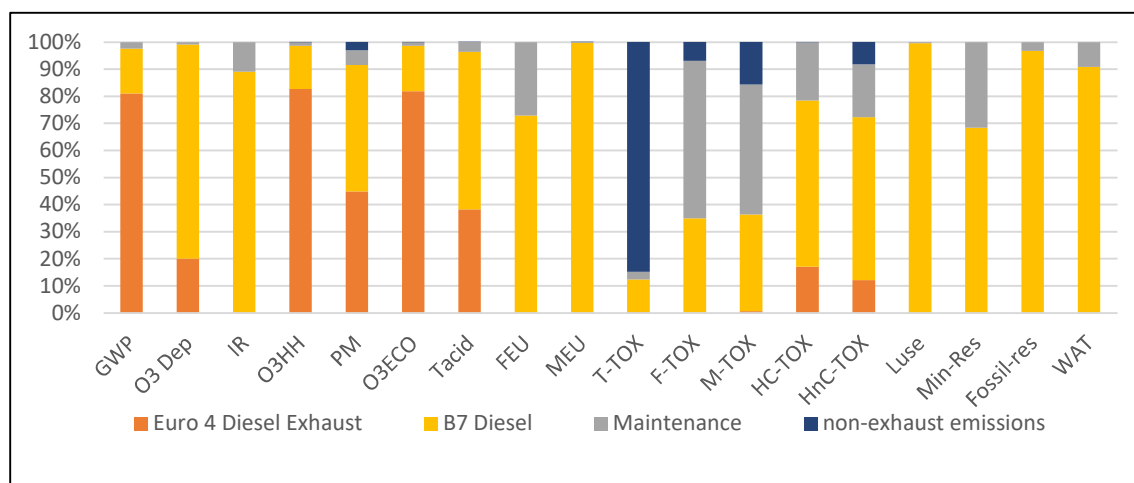


Figure S2. Environmental profile of a 1 km urban drive of a EURO 4 diesel passenger car

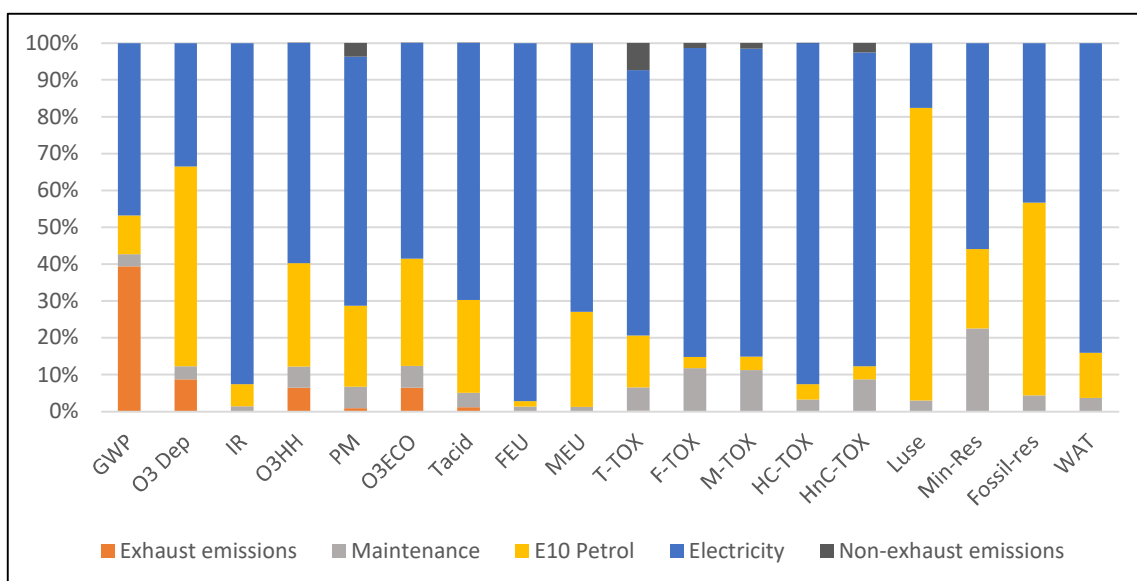


Figure S3. Environmental profile of a 1 km urban drive of a EURO 5 hybrid passenger car

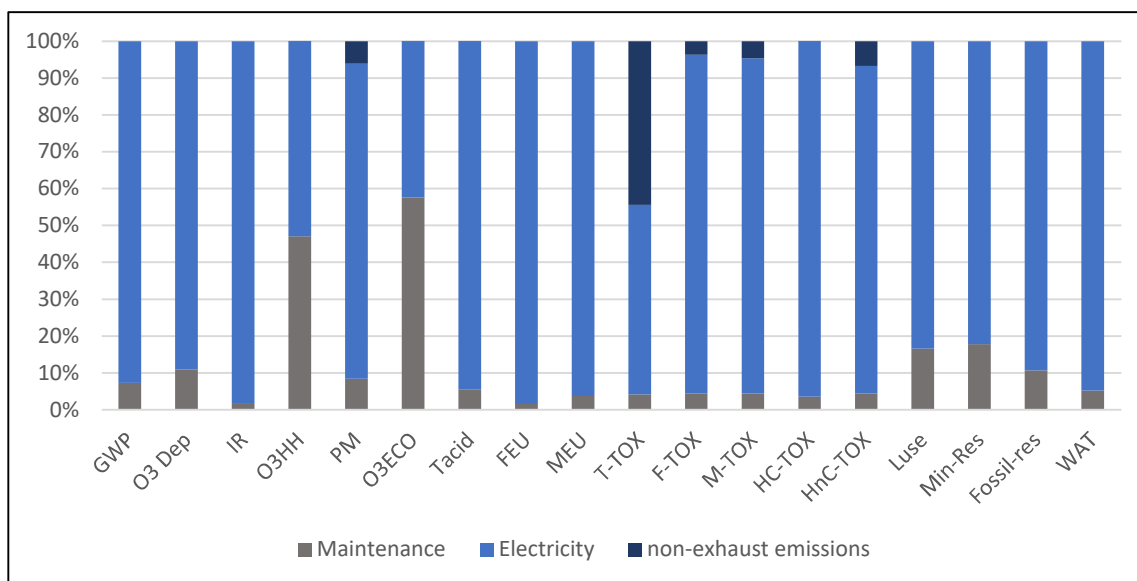


Figure S4. Environmental profile of a 1 km urban drive of an all electric passenger car