Supplementary material

Combining agent-based modeling and life cycle assessment for the evaluation of mobility policies

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38 pages, 19 tables, 35 figures

This supplementary material contains the main input data that were used to couple the ABM with LCA. The inputs are presented either in tables or in figures. When average (μ) data are considered, the following repartition convention has been adopted:

Min		Mmin		Mmax		Max
	10%		80%		10%	

S1. Vehicle production

S1.1 Vehicle weights

Glossary: ***ICEV:*** *internal combustion engine vehicle;* ***A:*** *mini car;* ***B:*** *small car;* ***C:*** *medium car;* ***D:*** *large car;* ***E:*** *executive car;* ***J:*** *sport utility vehicle (SUV);* ***M:*** *multipurpose car;* ***U:*** *utility vehicle.*

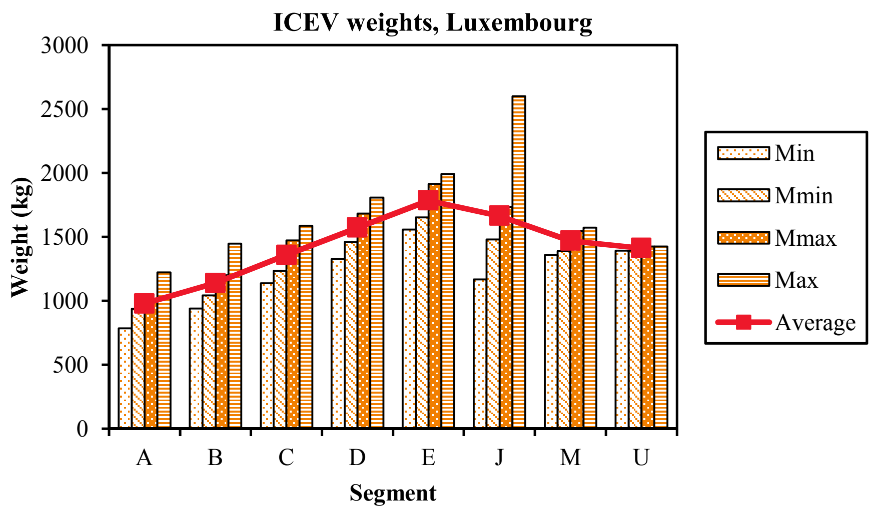


Figure S1.1.1: ICEV weights in Luxembourg in 2013 (kg).

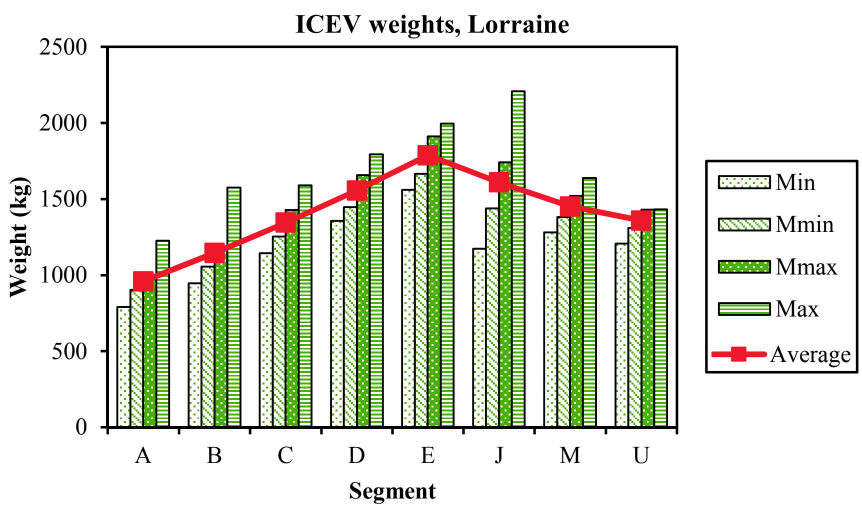


Figure S1.1.2: ICEV weights in Lorraine in 2013 (kg).

Luxembourg **Lorraine**

	Min	Mmin	Mmax	Max	Min	Mmin	Mmax	Max
A (mini)	-7.2	-8.5	-9.1	-11.1	-7.2	-8.2	-9.0	-11.1
B (small)	-8.6	-9.5	-10.9	-13.1	-8.6	-9.6	-10.7	-14.3
C (medium)	-10.4	-11.2	-13.4	-14.4	-10.4	-11.3	-12.9	-14.4
D (large)	-12.1	-13.3	-15.3	-16.4	-12.3	-13.1	-15.0	-16.3
E (executive)	-14.1	-15.0	-17.4	-18.1	-14.1	-15.1	-17.3	-18.1
J (sport-utility)	-10.6	-13.4	-15.8	-23.6	-10.6	-13.0	-15.8	-20.0
M (multipurpose)	-12.3	-12.6	-14.0	-14.3	-11.6	-12.5	-13.8	-14.9
U (utility)	-12.7	-12.7	-13.0	-13.0	-10.9	-11.9	-13.0	-13.0

Table S1.1.1: Weight change, per year (kg).

S1.2 Vehicle production impacts

Glossary: ***ALOP:*** *agricultural land occupation;* ***GWP_{100}:*** *global warming;* ***FDP:*** *fossil depletion;* ***$FETP_{inf}$:*** *freshwater ecotoxicity;* ***FEP:*** *freshwater eutrophication;* ***HTP_{inf}:*** *human toxicity;* ***IRP:*** *ionising radiation;* ***$METP_{inf}$:*** *marine ecotoxicity;* ***MEP:*** *marine eutrophication;* ***MDP:*** *metal depletion;* ***NLTP:*** *natural land transformation;* ***ODP_{inf}:*** *ozone depletion;* ***PMFP:*** *particulate matter formation;* ***POFP:*** *photochemical ozone formation;* ***TAP_{100}:*** *terrestrial acidification;* ***$TETP_{inf}$:*** *terrestrial ecotoxicity;* ***ULOP:*** *urban land occupation;* ***WDP:*** *water depletion;* ***C-segment BEV:*** *medium-size battery-powered electric vehicle;* ***C-segment PHEV:*** *medium-size plug-in hybrid electric vehicle;* ***C-segment SIICEV:*** *medium-size spark-ignition (gasoline) internal combustion engine vehicle;*

Year	2013	2014	2015	2016	2017	2018	2019	2020
Total weight (kg)	1542	1522	1502	1482	1462	1442	1422	1402
Glider weight (kg)	925	917	908	900	892	883	875	866
Powertrain weight (kg)	617	605	594	582	570	559	547	536
ALOP (m².yr)	1.80E+2	1.82E+2	1.79E+2	1.77E+2	1.75E+2	1.73E+2	1.70E+2	1.68E+2
GWP_{100} (kg $CO_{2\text{-eq.}}$)	7.30E+3	7.54E+3	7.44E+3	7.34E+3	7.24E+3	7.14E+3	7.04E+3	6.94E+3
FDP (kg $oil_{\text{-eq.}}$)	2.47E+3	2.52E+3	2.49E+3	2.46E+3	2.42E+3	2.39E+3	2.36E+3	2.33E+3
$FETP_{inf}$ (kg 1,4-$DCB_{\text{-eq.}}$)	2.98E+2	2.96E+2	2.92E+2	2.87E+2	2.82E+2	2.78E+2	2.73E+2	2.69E+2
FEP (kg $P_{\text{-eq.}}$)	1.32E+1	1.32E+1	1.30E+1	1.28E+1	1.25E+1	1.23E+1	1.21E+1	1.19E+1
HTP_{inf} (kg 1,4-$DCB_{\text{-eq.}}$)	2.23E+4	2.21E+4	2.18E+4	2.14E+4	2.11E+4	2.07E+4	2.04E+4	2.00E+4
IRP (kg $_{U235\text{-eq.}}$)	1.79E+3	1.86E+3	1.83E+3	1.81E+3	1.79E+3	1.76E+3	1.74E+3	1.71E+3
$METP_{inf}$ (kg 1,4-$DCB_{\text{-eq.}}$)	3.15E+2	3.13E+2	3.08E+2	3.03E+2	2.98E+2	2.94E+2	2.89E+2	2.84E+2
MEP (kg $N_{\text{-eq.}}$)	8.31E+0	8.42E+0	8.30E+0	8.18E+0	8.07E+0	7.95E+0	7.83E+0	7.71E+0
MDP (kg $Fe_{\text{-eq.}}$)	1.27E+4	1.24E+4	1.22E+4	1.20E+4	1.18E+4	1.16E+4	1.13E+4	1.11E+4
NLTP (m²)	1.68E+0	1.72E+0	1.69E+0	1.67E+0	1.65E+0	1.63E+0	1.60E+0	1.58E+0
ODP_{inf} (kg $CFC11_{\text{-eq.}}$)	7.78E-4	7.99E-4	7.89E-4	7.80E-4	7.70E-4	7.61E-4	7.51E-4	7.42E-4
PMFP (kg $PM_{10\text{-eq.}}$)	1.96E+1	1.98E+1	1.95E+1	1.92E+1	1.90E+1	1.87E+1	1.84E+1	1.81E+1
POFP (kg $NMVOC_{\text{-eq.}}$)	2.51E+1	2.56E+1	2.52E+1	2.48E+1	2.45E+1	2.41E+1	2.37E+1	2.34E+1
TAP_{100} (kg $SO_{2\text{-eq.}}$)	4.08E+1	4.16E+1	4.10E+1	4.04E+1	3.98E+1	3.92E+1	3.86E+1	3.80E+1
$TETP_{inf}$ (kg 1,4-$DCB_{\text{-eq.}}$)	1.48E+0	1.49E+0	1.47E+0	1.45E+0	1.43E+0	1.41E+0	1.39E+0	1.37E+0
ULOP (m².yr)	1.06E+2	1.05E+2	1.04E+2	1.02E+2	1.01E+2	9.95E+1	9.80E+1	9.65E+1
WDP (m³)	3.32E+2	3.36E+2	3.33E+2	3.30E+2	3.27E+2	3.24E+2	3.21E+2	3.18E+2

Table S1.2.1: Potential impacts linked with the production of a C-segment BEV, according to the year of simulation.

Year	2013	2014	2015	2016	2017	2018	2019	2020
Total weight (kg)	1420	1402	1383	1365	1346	1328	1310	1291
Glider weight (kg)	852	844	837	829	821	813	806	798
Powertrain weight (kg)	568	557	547	536	525	515	504	493
ALOP (m².yr)	1.64E+2	1.65E+2	1.63E+2	1.61E+2	1.59E+2	1.57E+2	1.55E+2	1.53E+2
GWP_{100} (kg $CO_{2\text{-eq.}}$)	6.47E+3	6.74E+3	6.67E+3	6.59E+3	6.51E+3	6.44E+3	6.36E+3	6.28E+3
FDP (kg $oil_{\text{-eq.}}$)	2.23E+3	2.30E+3	2.27E+3	2.24E+3	2.22E+3	2.19E+3	2.16E+3	2.14E+3

FETP$_{inf}$ (kg 1,4-DCB$_{-eq.}$)	1.74E+2	1.74E+2	1.71E+2	1.67E+2	1.63E+2	1.60E+2	1.56E+2	1.53E+2
FEP (kg P$_{-eq.}$)	7.17E+0	7.23E+0	7.06E+0	6.90E+0	6.74E+0	6.58E+0	6.42E+0	6.27E+0
HTP$_{inf}$ (kg 1,4-DCB$_{-eq.}$)	1.09E+4	1.09E+4	1.06E+4	1.03E+4	1.00E+4	9.75E+3	9.48E+3	9.21E+3
IRP (kg $_{U235-eq.}$)	1.75E+3	1.82E+3	1.80E+3	1.79E+3	1.77E+3	1.75E+3	1.73E+3	1.71E+3
METP$_{inf}$ (kg 1,4-DCB$_{-eq.}$)	1.83E+2	1.84E+2	1.80E+2	1.76E+2	1.72E+2	1.68E+2	1.64E+2	1.61E+2
MEP (kg N$_{-eq.}$)	6.36E+0	6.53E+0	6.43E+0	6.34E+0	6.25E+0	6.15E+0	6.06E+0	5.97E+0
MDP (kg Fe$_{-eq.}$)	7.44E+3	7.32E+3	7.16E+3	7.01E+3	6.85E+3	6.70E+3	6.54E+3	6.39E+3
NLTP (m²)	1.34E+0	1.39E+0	1.37E+0	1.35E+0	1.33E+0	1.31E+0	1.29E+0	1.28E+0
ODP$_{inf}$ (kg CFC11$_{-eq.}$)	7.14E-4	7.35E-4	7.27E-4	7.19E-4	7.11E-4	7.03E-4	6.95E-4	6.86E-4
PMFP (kg PM$_{10-eq.}$)	1.67E+1	1.71E+1	1.68E+1	1.66E+1	1.64E+1	1.61E+1	1.59E+1	1.57E+1
POFP (kg NMVOC$_{-eq.}$)	2.00E+1	2.06E+1	2.03E+1	2.00E+1	1.98E+1	1.95E+1	1.92E+1	1.89E+1
TAP$_{100}$ (kg SO$_{2-eq.}$)	3.65E+1	3.73E+1	3.68E+1	3.63E+1	3.58E+1	3.52E+1	3.47E+1	3.42E+1
TETP$_{inf}$ (kg 1,4-DCB$_{-eq.}$)	1.11E+0	1.13E+0	1.11E+0	1.10E+0	1.08E+0	1.06E+0	1.05E+0	1.03E+0
ULOP (m².yr)	7.68E+1	7.68E+1	7.55E+1	7.42E+1	7.30E+1	7.17E+1	7.05E+1	6.93E+1
WDP (m³)	3.28E+2	3.31E+2	3.27E+2	3.23E+2	3.19E+2	3.15E+2	3.11E+2	3.07E+2

Table S1.2.2: Potential impacts linked with the production of a C-segment PHEV, according to the year of simulation.

Year	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Total weight (kg)	1357	1343	1330	1316	1302	1288	1275	1261
Glider weight (kg)	1054	1040	1027	1013	999	985	972	958
Powertrain weight (kg)	303	303	303	303	303	303	303	303
ALOP (m².yr)	1.59E+2	1.62E+2	1.61E+2	1.59E+2	1.58E+2	1.56E+2	1.55E+2	1.53E+2
GWP$_{100}$ (kg CO$_{2-eq.}$)	5.95E+3	6.30E+3	6.26E+3	6.22E+3	6.18E+3	6.14E+3	6.10E+3	6.06E+3
FDP (kg oil$_{-eq.}$)	2.11E+3	2.20E+3	2.18E+3	2.16E+3	2.15E+3	2.13E+3	2.11E+3	2.10E+3
FETP$_{inf}$ (kg 1,4-DCB$_{-eq.}$)	1.10E+2	1.12E+2	1.11E+2	1.10E+2	1.09E+2	1.08E+2	1.08E+2	1.07E+2
FEP (kg P$_{-eq.}$)	4.13E+0	4.27E+0	4.25E+0	4.22E+0	4.19E+0	4.17E+0	4.14E+0	4.11E+0
HTP$_{inf}$ (kg 1,4-DCB$_{-eq.}$)	5.27E+3	5.39E+3	5.36E+3	5.32E+3	5.29E+3	5.25E+3	5.21E+3	5.18E+3
IRP (kg $_{U235-eq.}$)	1.65E+3	1.74E+3	1.73E+3	1.72E+3	1.71E+3	1.70E+3	1.69E+3	1.68E+3
METP$_{inf}$ (kg 1,4-DCB$_{-eq.}$)	1.15E+2	1.17E+2	1.16E+2	1.16E+2	1.15E+2	1.14E+2	1.13E+2	1.12E+2
MEP (kg N$_{-eq.}$)	5.32E+0	5.54E+0	5.50E+0	5.47E+0	5.43E+0	5.39E+0	5.35E+0	5.31E+0
MDP (kg Fe$_{-eq.}$)	4.40E+3	4.25E+3	4.21E+3	4.16E+3	4.12E+3	4.07E+3	4.03E+3	3.98E+3
NLTP (m²)	1.16E+0	1.23E+0	1.22E+0	1.21E+0	1.20E+0	1.19E+0	1.19E+0	1.18E+0
ODP$_{inf}$ (kg CFC11$_{-eq.}$)	7.03E-4	7.32E-4	7.26E-4	7.20E-4	7.15E-4	7.09E-4	7.03E-4	6.98E-4
PMFP (kg PM$_{10-eq.}$)	1.35E+1	1.41E+1	1.40E+1	1.39E+1	1.38E+1	1.38E+1	1.37E+1	1.36E+1
POFP (kg NMVOC$_{-eq.}$)	1.68E+1	1.76E+1	1.75E+1	1.74E+1	1.73E+1	1.71E+1	1.70E+1	1.69E+1
TAP$_{100}$ (kg SO$_{2-eq.}$)	2.85E+1	3.00E+1	2.99E+1	2.98E+1	2.97E+1	2.96E+1	2.95E+1	2.93E+1
TETP$_{inf}$ (kg 1,4-DCB$_{-eq.}$)	9.41E-1	9.67E-1	9.59E-1	9.51E-1	9.44E-1	9.36E-1	9.28E-1	9.20E-1
ULOP (m².yr)	6.26E+1	6.32E+1	6.26E+1	6.21E+1	6.15E+1	6.10E+1	6.04E+1	5.99E+1
WDP (m³)	3.89E+2	3.94E+2	3.90E+2	3.86E+2	3.81E+2	3.77E+2	3.73E+2	3.69E+2

Table S1.2.3: Potential impacts linked with the production of an average C-segment Luxembourgish SIICEV, according to the year of simulation.

ALOP	**GWP$_{100}$**	**FDP**	**FETP$_{inf}$**	**FEP**	**HTP$_{inf}$**	**IRP HE**	**METP$_{inf}$**	**MEP**	**ALOP**
1.30E+0	1.20E+2	3.63E+1	1.51E+0	1.11E-1	7.03E+1	4.31E+1	1.48E+0	6.24E-2	1.30E+0

MDP	**NLTP**	**ODP$_{inf}$**	**PMFP**	**POFP**	**TAP$_{100}$**	**TETP$_{inf}$**	**ULOP**	**WDP**	**MDP**
1.70E+0	1.25E-2	8.41E-6	5.56E-2	1.35E-1	1.57E-1	5.50E-3	3.20E-1	1.74E+1	1.70E+0

Table S1.2.4: Impacts linked with the assembly of an average 1,350kg vehicle (C-segment).

S2. Vehicle use

S2.1 Fuel and electricity consumptions

<u>Glossary:</u> ***SIICEV:*** *spark-ignition (gasoline) internal combustion engine vehicle;* ***CIICEV:*** *combustion-ignition (diesel) internal combustion engine vehicle.*

As described in the main article, fuel consumption is calculated according to the following formula:

$$\text{FC} = \frac{A \times Aux + B}{100}$$

With:

- FC = fuel consumption (L / km).
- A = additional consumption linked with auxiliary use (L / 100km / kW).
- Aux = use of auxiliary (kW).
- B = base fuel consumption (L / 100 km).

The following 12 figures present A- and B-coefficients, depending on vehicle type, driving cycle and region.

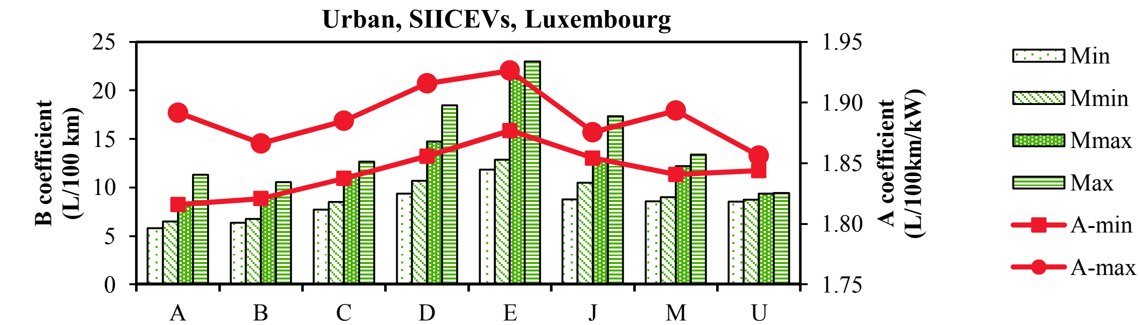


Figure S2.1.1: SIICEV urban Artemis fuel consumptions in Luxembourg, 2013. Bar chart represents B-coefficients while red line corresponds to A-coefficients.

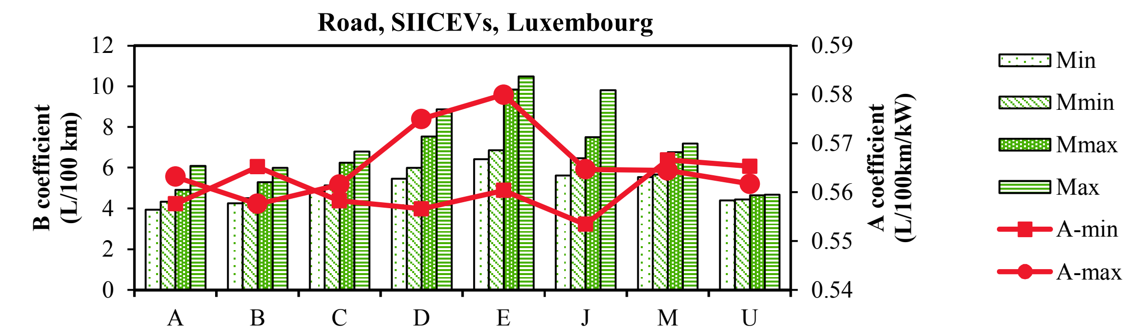


Figure S2.1.2: SIICEV road Artemis fuel consumptions in Luxembourg, 2013. Bar chart represents B-coefficients while red line corresponds to A-coefficients.

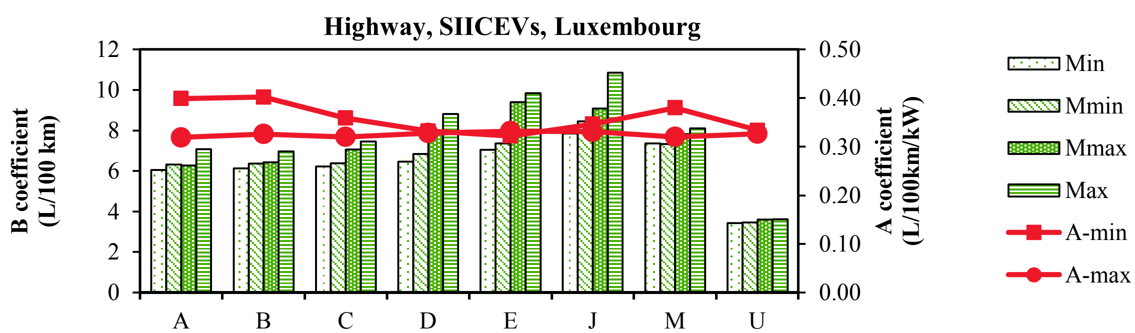


Figure S2.1.3: SIICEV highway Artemis fuel consumptions in Luxembourg, 2013. Bar chart represents B-coefficients while red line corresponds to A-coefficients.

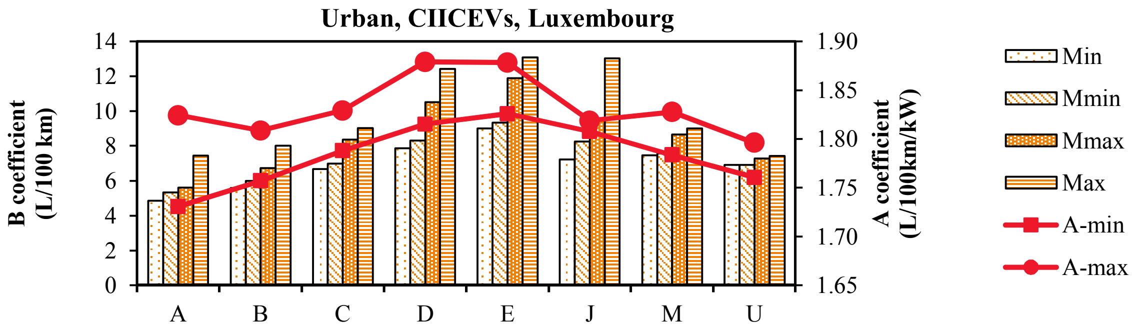


Figure S2.1.4: CIICEV urban fuel consumptions in Luxembourg, 2013. Bar chart represents B-coefficients while red line corresponds to A-coefficients.

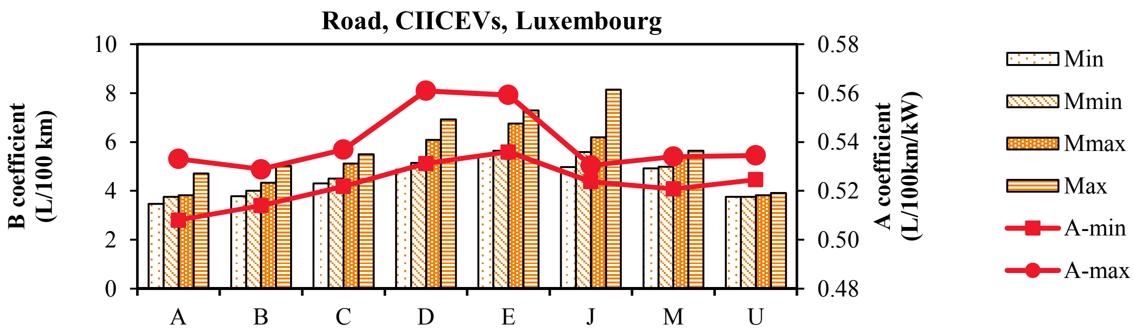


Figure S2.1.5: CIICEV road fuel consumptions in Luxembourg, 2013. Bar chart represents B-coefficients while red line corresponds to A-coefficients.

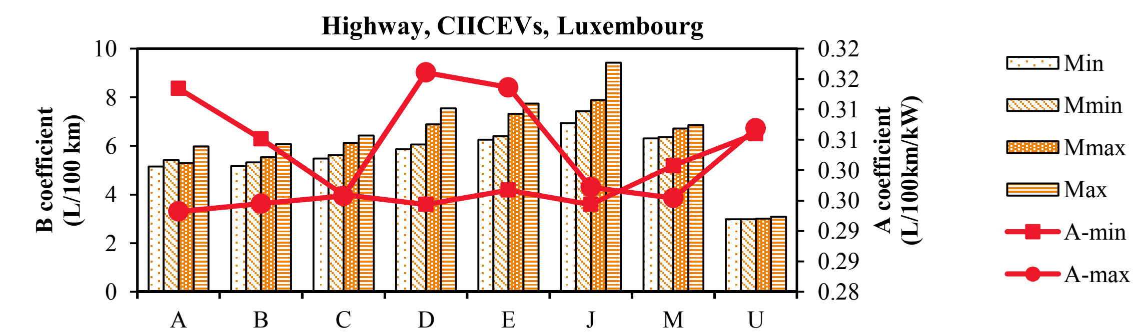


Figure S2.1.6: CIICEV highway fuel consumptions in Luxembourg, 2013. Bar chart represents B-coefficients while red line corresponds to A-coefficients.

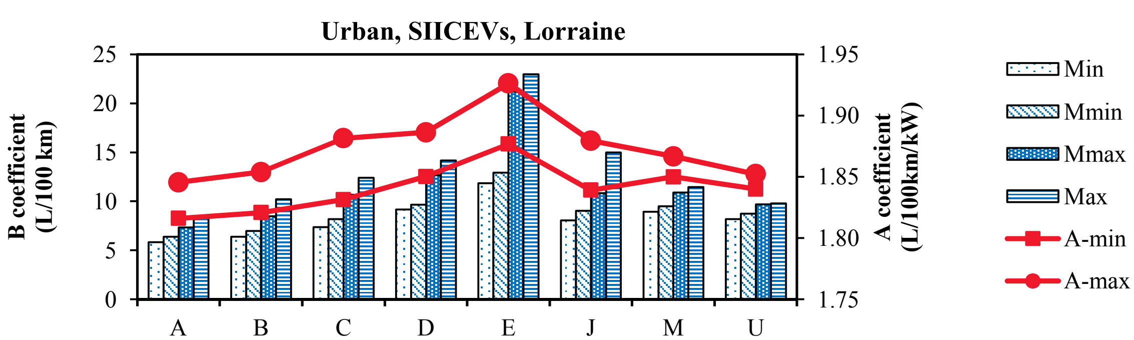


Figure S2.1.7: SIICEV urban fuel consumptions in Lorraine, 2013. Bar chart represents B-coefficients while red line corresponds to A-coefficients.

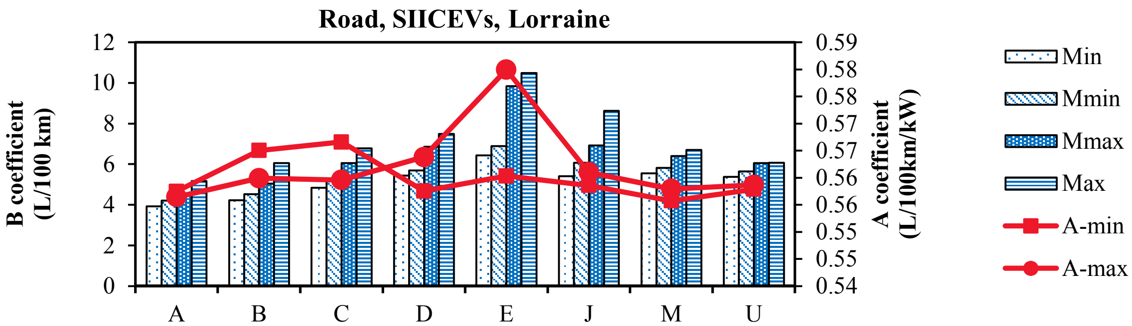


Figure S2.1.8: SIICEV road fuel consumptions in Lorraine, 2013. Bar chart represents B-coefficients while red line corresponds to A-coefficients.

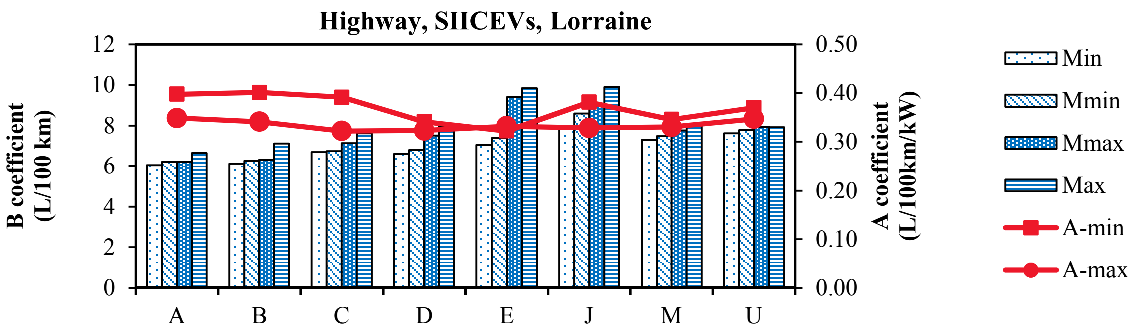


Figure S2.1.9: SIICEV highway fuel consumptions in Lorraine, 2013. Bar chart represents B-coefficients while red line corresponds to A-coefficients.

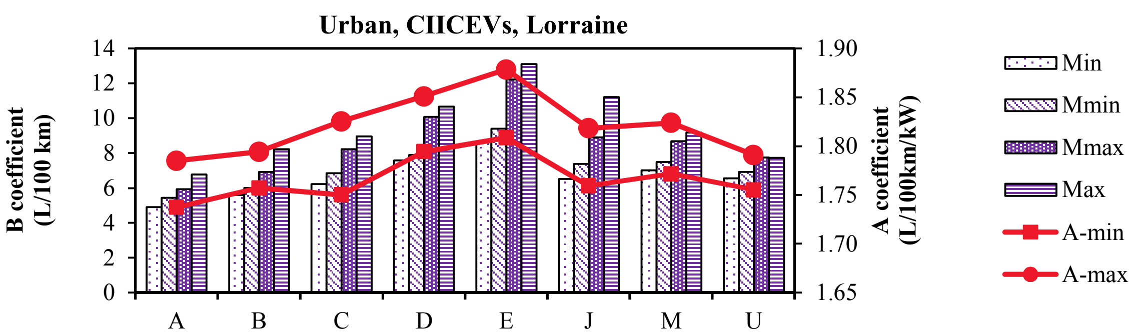


Figure S2.1.10: CIICEV urban fuel consumptions in Lorraine, 2013. Bar chart represents B-coefficients while red line corresponds to A-coefficients.

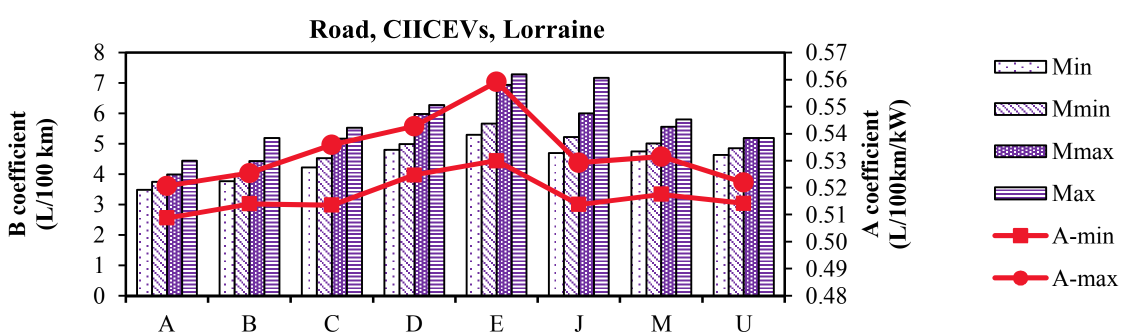


Figure S2.1.11 CIICEV road fuel consumptions in Lorraine, 2013. Bar chart represents B-coefficients while red line corresponds to A-coefficients.

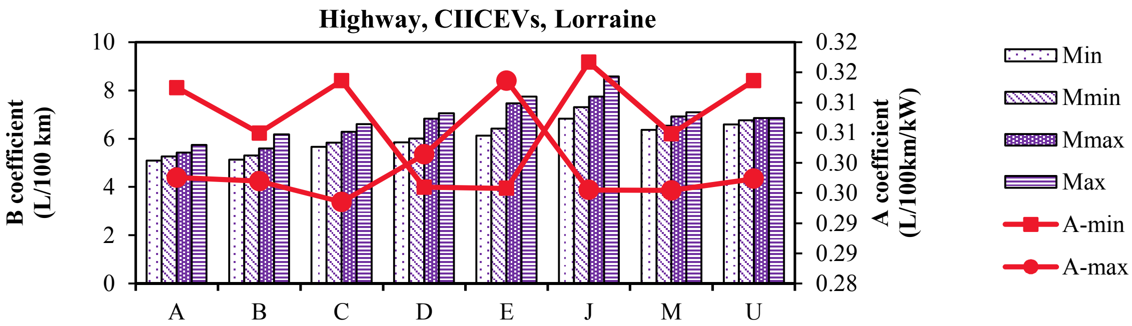


Figure S2.1.12: CIICEV highway fuel consumptions in Lorraine, 2013. Bar chart represents B-coefficients while red line corresponds to A-coefficients.

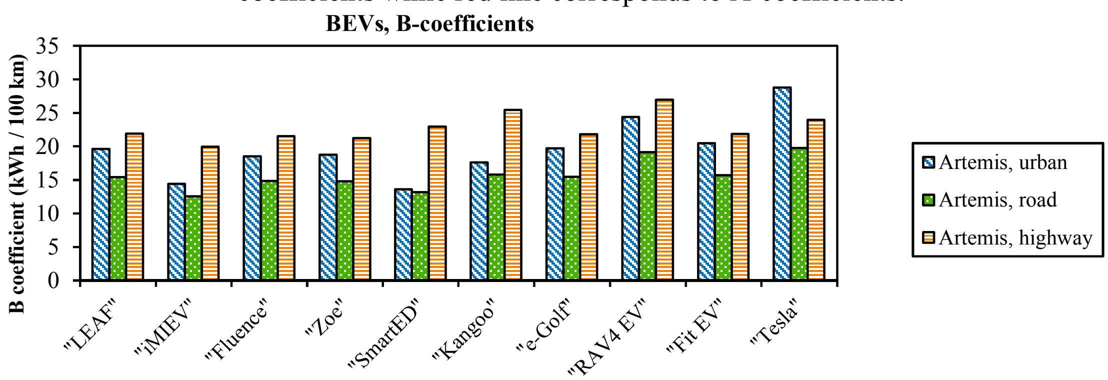


Figure S2.1.13: BEV electricity consumption, B-coefficients, 2013.

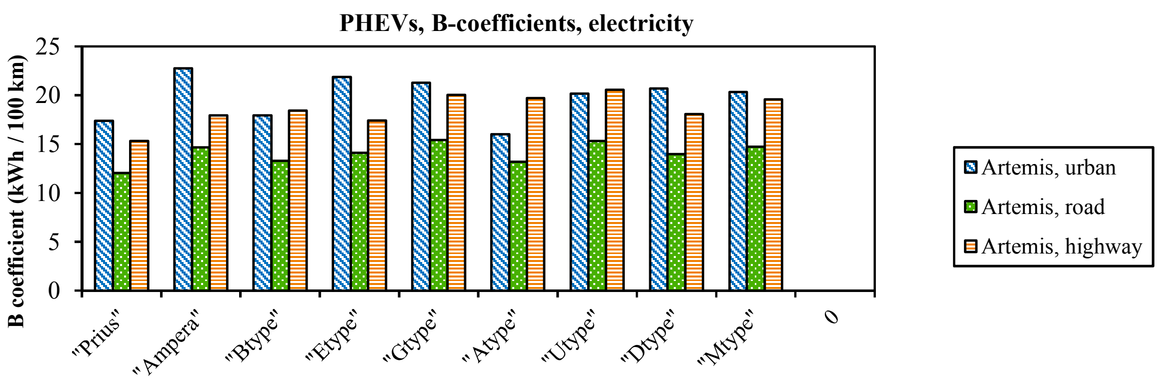


Figure S2.1.14: PHEV electricity consumption, B-coefficients, 2013.

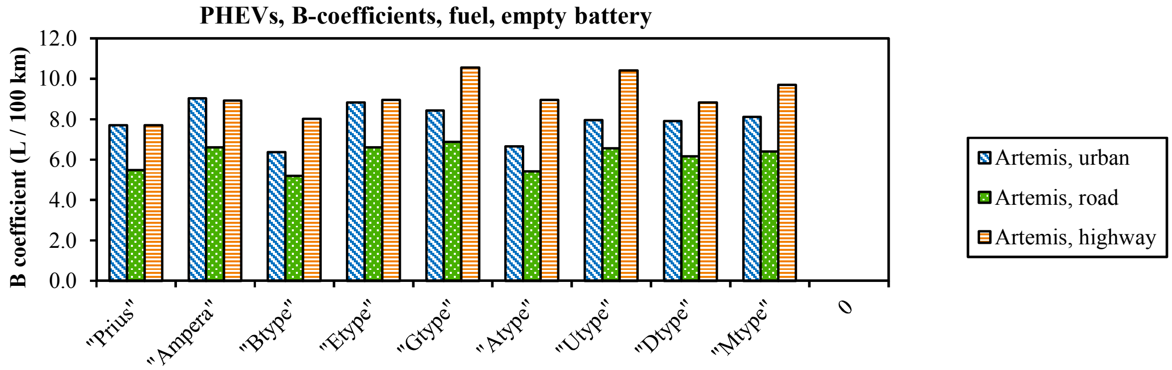


Figure S2.1.15: PHEV fuel consumption (when battery is empty), B-coefficients, 2013.

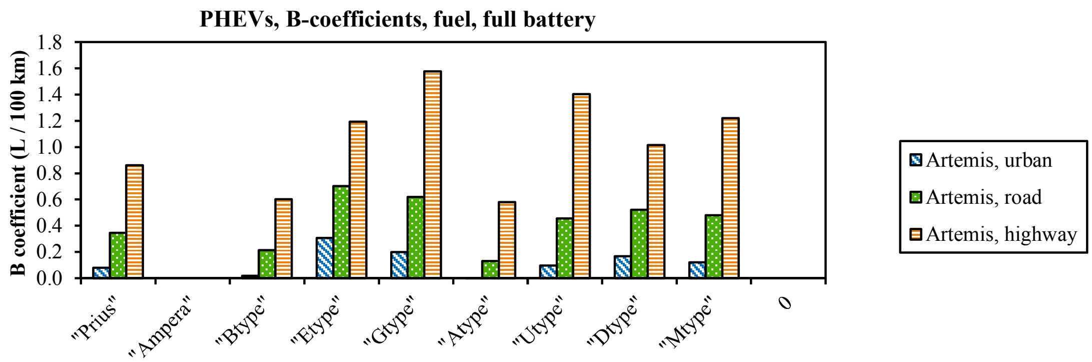


Figure S2.1.16: PHEV fuel consumption (when battery is full), B-coefficients, 2013.

	BEV	PHEV, electricity	PHEV, fuel, empty bat.	PHEV, fuel, full bat.
Artemis Urban	6.7	9.2	4.0	<0.0
Artemis Road	2.0	2.4	1.2	1.4
Artemis Highway	1.2	1.1	0.7	0.1

Table S2.1.1: Average A-coefficients for BEvs and PHEVs, 2013.

S2.2 Tailpipe impacts (/km)

Glossary: ***CIICEV:*** *compression-ignition (diesel) internal combustion engine vehicle;* ***MEP:*** *marine eutrophication;* ***NMVOC:*** *non-methane volatile organic compounds;* ***PM:*** *particulate matter;* ***PMFP:*** *particulate matter formation;* ***POFP:*** *photochemical ozone formation;* ***SIICEV:*** *spark-ignition (gasoline) internal combustion engine vehicle;* ***TAP_{100}:*** *terrestrial acidification;*

(mg / km)	**Euro5**			**Euro6**		
	Urban	Road	Highway	Urban	Road	Highway
NMVOC	10	14	21	10	14	21
CO	157	240	487	157	240	487
NO_x	61	29	15	61	29	15
CH_4	3	3	3	3	3	3
PM	1	1	1	1	1	1

Table S2.2.1: Tailpipe raw hot emissions of SIICEVs, depending on aftertreatment standard and driving cycle.

(mg / km)	**Euro5**			**Euro6**		
	Urban	Road	Highway	Urban	Road	Highway
NMVOC	25	47	5	25	47	5
CO	201	48	22	201	48	22

NO_x	980	507	575	343	177	201
CH_4	1	1	1	1	1	1
PM	2	1	1	2	1	1

Table S2.2.2: Tailpipe raw hot emissions of CIICEVs, depending on aftertreatment standard and driving cycle.

	Euro5			**Euro6**		
	Urban	Road	Highway	Urban	Road	Highway
MEP	2.35E-5	1.14E-5	5.81E-6	2.35E-5	1.14E-5	5.81E-6
PMFP	1.46E-5	7.72E-6	4.57E-6	1.46E-5	7.72E-6	4.57E-6
POFP	7.75E-5	5.40E-5	5.77E-5	7.75E-5	5.40E-5	5.77E-5
TAP_{100}	3.39E-5	5.40E-5	5.77E-5	3.39E-5	5.40E-5	5.77E-5

Table S2.2.3: Tailpipe hot impacts of SIICEVs, depending on aftertreatment standard and driving cycle.

	Euro5			**Euro6**		
	Urban	Road	Highway	Urban	Road	Highway
MEP	3.81E-4	1.97E-4	2.24E-4	1.33E-4	6.89E-5	7.82E-5
PMFP	2.17E-4	1.13E-4	1.28E-4	7.72E-5	4.03E-5	4.56E-5
POFP	1.01E-3	5.56E-4	5.81E-4	3.77E-4	2.26E-4	2.07E-4
TAP_{100}	5.49E-4	2.84E-4	3.22E-4	1.92E-4	9.92E-5	1.13E-4

Table S2.2.4: Tailpipe hot impacts of CIICEVs, depending on aftertreatment standard and driving cycle.

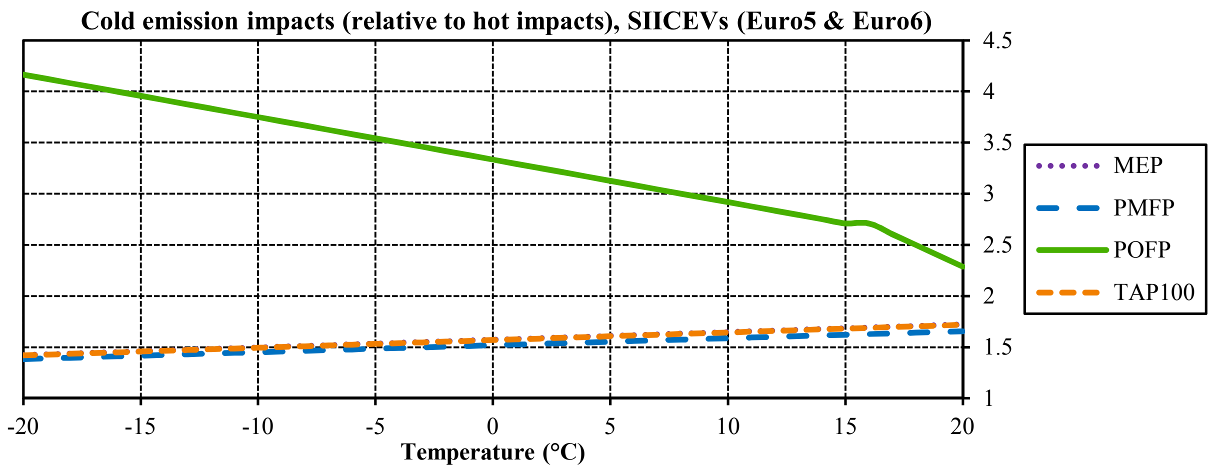


Figure S2.1.17: SIICEV cold tailpipe impacts, relative to hot impacts, depending on external temperature.

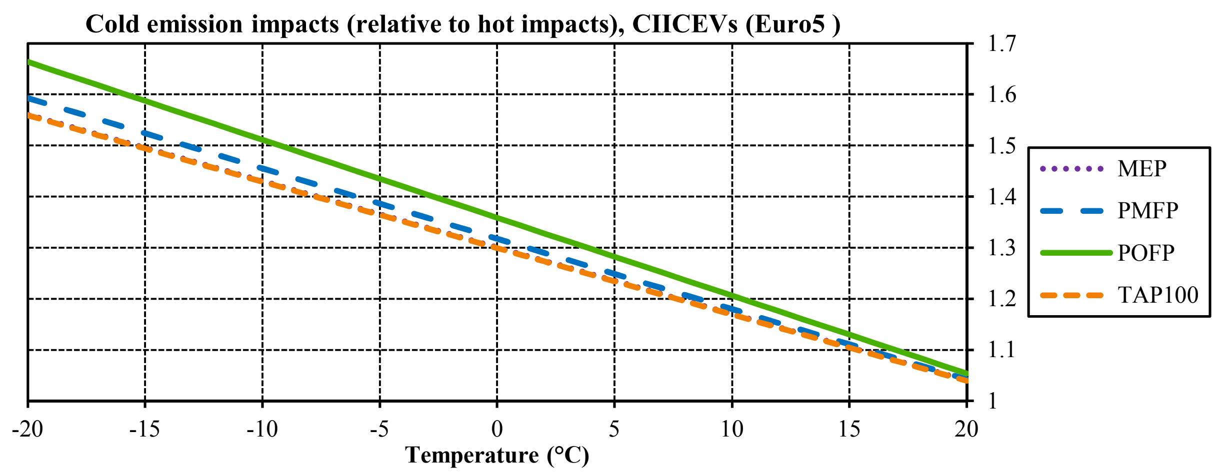


Figure S2.1.18: Euro 5 CIICEV cold tailpipe impacts, relative to hot impacts, depending on external temperature.

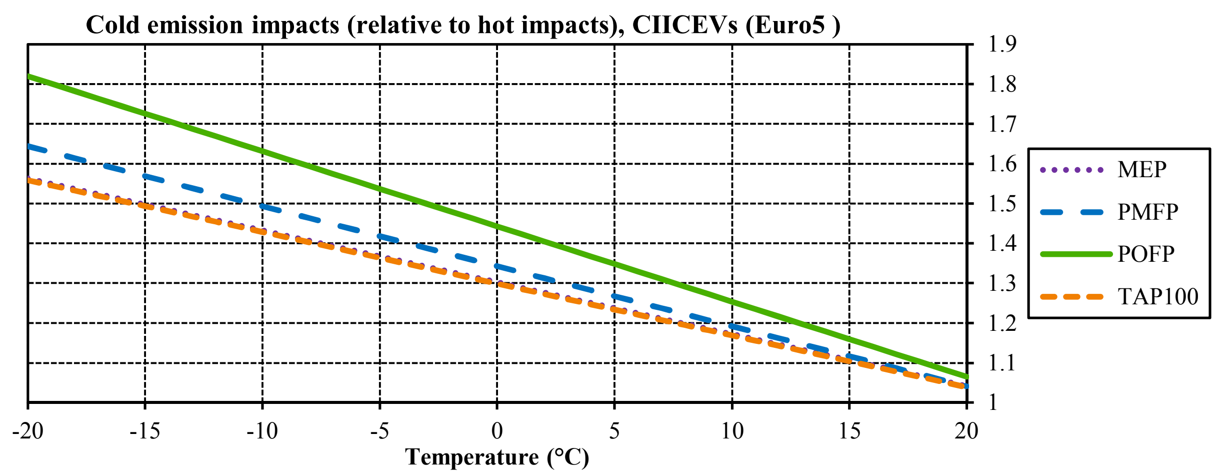


Figure S2.1.19: Euro 6 CIICEV cold tailpipe impacts, relative to hot impacts, depending on external temperature.

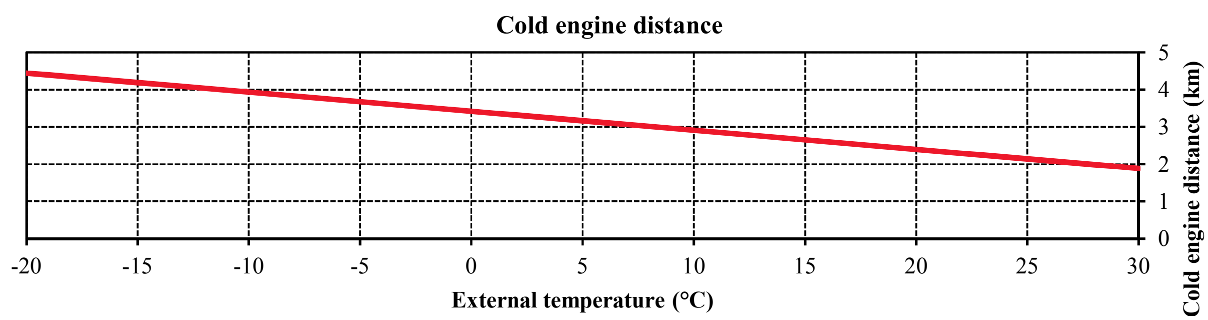


Figure S2.1.20: Distance in urban environment, when engine is started, to go from cold engine emission to warm engine, depending on external temperature.

S2.3 Fuel and electricity impacts

Glossary: ***ALOP:*** *agricultural land occupation;* ***GWP$_{100}$:*** *global warming;* ***FDP:*** *fossil depletion;* ***FETP$_{inf}$:*** *freshwater ecotoxicity;* ***FEP:*** *freshwater eutrophication;* ***HTP$_{inf}$:*** *human toxicity;* ***IRP:*** *ionising radiations;* ***METP$_{inf}$:*** *marine tcotoxicity;* ***MEP:*** *marine eutrophication;* ***MDP:*** *metal depletion;* ***NLTP:***

natural land transformation; ***ODP$_{inf}$:*** *ozone depletion;* ***PMFP:*** *particulate matter formation;* ***POFP:*** *photochemical ozone formation;* ***TAP$_{100}$:*** *terrestrial acidification;* ***TETP$_{inf}$:*** *terrestrial ecotoxicity;* ***ULOP:*** *Urban land occupation;* ***WDP:*** *water depletion;*

Impact	**Luxembourg**				**Lorraine**			
	Average electricity		Renewable electricity		Average electricity		Renewable electricity	
	2013	↗ per year	2013	↗ per year	2013	↗ per year	2013	↗ per year
ALOP (m².yr)	4.26E-3	-5.32E-5	1.06E-3	+7.04E-5	1.43E-3	-9.16E-6	4.04E-4	+4.44E-5
GWP$_{100}$ (kg $CO_{2\text{-eq.}}$)	6.88E-1	-3.01E-2	3.54E-2	+2.17E-3	1.19E-1	-1.84E-3	2.22E-2	+1.37E-3
FDP (kg oil$_{\text{-eq.}}$)	2.30E-1	-1.12E-2	6.20E-3	+3.93E-4	3.57E-2	-6.06E-4	5.25E-3	+3.17E-4
FETP$_{inf}$ (kg 1,4-DCB$_{\text{-eq.}}$)	6.98E-3	-1.96E-4	4.60E-4	+3.10E-5	1.40E-3	-1.57E-5	4.53E-4	+2.71E-5
FEP (kg P$_{\text{-eq.}}$)	5.15E-4	-1.56E-5	1.90E-5	+1.32E-6	7.94E-5	-1.33E-6	1.78E-5	+9.65E-7
HTP$_{inf}$ (kg 1,4-DCB$_{\text{-eq.}}$)	3.21E-1	-8.46E-3	2.58E-2	+1.85E-3	9.39E-2	-1.13E-3	2.41E-2	+1.44E-3
IRP (kg $U^{235}$$_{\text{-eq.}}$)	1.59E-1	-4.34E-3	4.39E-3	+2.90E-4	1.25E0	-2.28E-2	3.12E-3	+2.36E-4
METP$_{inf}$ (kg 1,4-DCB$_{\text{-eq.}}$)	6.85E-3	-1.93E-4	4.27E-4	+2.95E-5	1.52E-3	-1.83E-5	4.16E-4	+2.80E-5
MEP (kg N$_{\text{-eq.}}$)	3.98E-4	-1.01E-5	1.10E-4	+6.93E-6	1.48E-4	-3.35E-7	9.02E-5	+3.48E-6
MDP (kg Fe$_{\text{-eq.}}$)	5.12E-3	+3.44E-4	4.71E-3	+2.69E-4	6.61E-3	+1.38E-4	5.14E-3	+5.54E-4
NLTP (m²)	9.01E-5	-4.96E-6	1.83E-6	+1.59E-7	1.64E-5	-2.77E-7	2.11E-6	+9.12E-8
ODP$_{inf}$ (kg CFC11$_{\text{-eq.}}$)	8.40E-7	-2.92E-8	2.46E-9	+1.75E-0	4.89E-8	-1.48E-9	1.88E-9	+1.39E-0
PMFP (kg PM10$_{\text{-eq.}}$)	8.89E-2	-2.62E-3	1.18E-4	+6.36E-6	5.03E-3	-1.44E-4	8.13E-5	+3.42E-6
POFP (kg NMVOC$_{\text{-eq.}}$)	9.21E-4	-2.59E-5	2.83E-4	+1.77E-5	3.89E-4	-7.26E-7	2.37E-4	+9.08E-6
TAP$_{100}$ (kg $SO_{2\text{-eq.}}$)	9.30E-4	-9.67E-6	4.31E-4	+2.71E-5	6.12E-4	-4.54E-6	2.07E-4	+1.35E-5
TETP$_{inf}$ (kg 1,4-DCB$_{\text{-eq.}}$)	6.02E-6	+1.38E-8	8.34E-6	+8.36E-7	1.11E-5	+1.71E-7	5.35E-6	+8.83E-7
ULOP (m².yr)	1.43E-3	-1.67E-5	3.82E-4	+2.60E-5	7.65E-4	+2.75E-6	4.18E-4	+3.70E-5
WDP (m³)	4.12E-3	-1.34E-4	4.33E-4	+2.67E-5	6.64E-3	-1.11E-4	4.14E-4	+1.58E-5

Table S2.3.1: Environmental impacts associated with the production of 1kWh of electricity, depending on the source (average or renewable mix) and region. Values are presented for 2013 and followed by their yearly variation.

Impact	**Luxembourg**				**Lorraine**			
	Gasoline		Diesel fuel		Gasoline		Diesel fuel	
	2013	↗ per year	2013	↗ per year	2013	↗ per year	2013	↗ per year
ALOP (m².yr)	4.60E-1	+5.59E-2	4.60E-1	+1.84E-2	5.86E-1	+8.21E-2	4.60E-1	+1.84E-2
GWP$_{100}$ (kg $CO_{2\text{-eq.}}$)	2.73E0	-8.43E-3	2.73E0	-3.20E-3	2.71E0	-1.24E-2	2.73E0	-3.20E-3
FDP (kg oil$_{\text{-eq.}}$)	9.57E-1	-5.05E-3	9.57E-1	-2.84E-3	9.46E-1	-7.42E-3	9.57E-1	-2.84E-3
FETP$_{inf}$ (kg 1,4-DCB$_{\text{-eq.}}$)	8.18E-3	+6.68E-4	8.18E-3	+4.29E-4	9.68E-3	+9.81E-4	8.18E-3	+4.29E-4
FEP (kg P$_{\text{-eq.}}$)	1.52E-4	+7.64E-6	1.52E-4	+4.43E-6	1.69E-4	+1.12E-5	1.52E-4	+4.43E-6
HTP$_{inf}$ (kg 1,4-DCB$_{\text{-eq.}}$)	1.35E-1	+4.44E-3	1.35E-1	+2.02E-3	1.44E-1	+6.53E-3	1.35E-1	+2.02E-3
IRP (kg $U^{235}$$_{\text{-eq.}}$)	7.49E-2	+1.18E-3	7.49E-2	+9.39E-4	7.75E-2	+1.74E-3	7.49E-2	+9.39E-4
METP$_{inf}$ (kg 1,4-DCB$_{\text{-eq.}}$)	3.68E-3	+7.57E-5	3.68E-3	+5.16E-5	3.85E-3	+1.11E-4	3.68E-3	+5.16E-5
MEP (kg N$_{\text{-eq.}}$)	1.28E-3	+7.77E-5	1.28E-3	+6.31E-5	1.46E-3	+1.14E-4	1.28E-3	+6.31E-5
MDP (kg Fe$_{\text{-eq.}}$)	1.86E-2	+7.53E-4	1.86E-2	+4.47E-4	2.03E-2	+1.11E-3	1.86E-2	+4.47E-4
NLTP (m²)	1.33E-3	-9.54E-6	1.33E-3	-5.70E-6	1.31E-3	-1.40E-5	1.33E-3	-5.70E-6
ODP$_{inf}$ (kg CFC11$_{\text{-eq.}}$)	3.40E-7	-1.59E-9	3.40E-7	-1.08E-9	3.36E-7	-2.33E-9	3.40E-7	-1.08E-9
PMFP (kg PM10$_{\text{-eq.}}$)	1.55E-3	+1.67E-5	1.55E-3	+1.24E-5	1.59E-3	+2.46E-5	1.55E-3	+1.24E-5
POFP (kg NMVOC$_{\text{-eq.}}$)	3.35E-3	+3.04E-5	3.35E-3	+2.39E-5	3.42E-3	+4.47E-5	3.35E-3	+2.39E-5
TAP$_{100}$ (kg $SO_{2\text{-eq.}}$)	5.74E-3	+6.59E-5	5.74E-3	+5.54E-5	5.89E-3	+9.68E-5	5.74E-3	+5.54E-5
TETP$_{inf}$ (kg 1,4-DCB$_{\text{-eq.}}$)	1.92E-2	+2.32E-3	1.92E-2	+1.97E-3	2.44E-2	+3.41E-3	1.92E-2	+1.97E-3
ULOP (m².yr)	7.22E-3	+2.65E-4	7.22E-3	+3.63E-4	7.82E-3	+3.90E-4	7.22E-3	+3.63E-4
WDP (m³)	4.22E-3	+8.48E-5	4.22E-3	+2.98E-5	4.41E-3	+1.25E-4	4.22E-3	+2.98E-5

Table S2.3.2: Environmental impacts associated with the production of 1L of fuel, depending on the region. Values are presented for 2013 and followed by their yearly variation.

	Ethanol			**Biodiesel**		
	2010	↗ per year	2020	2010	↗ per year	2020

Luxembourg	4.7%	+0.33%	7%	4.7%	+0.33%	7%
Lorraine	6%	+0.57%	10%	6%	+0.57%	10%

Table S2.3.3: Biofuel blend in fuel used in the calculations. Rates are expressed in energy content (based on lower heating values of fuels).

S2.4 Vehicle maintenance

Glossary: ***ACF:*** *air-conditioning fluid;* ***ALOP:*** *agricultural land occupation;* ***BEV:*** *battery-powered electric vehicle;* ***BF:*** *brake fluid;* ***CF:*** *cooling fluid;* ***CIICEV:*** *compression-ignition (diesel) internal combustion engine vehicle;* ***CW:*** *car wash;* ***DR:*** *drain;* ***FDP:*** *fossil depletion;* ***FEP:*** *freshwater eutrophication;* **$FETP_{inf}$:** *freshwater toxicity;* **GWP_{100}:** *global warming;* **$HTTP_{inf}$:** *human toxicity;* ***IRP;*** *ionizing radiations;* ***LB:*** *lead battery;* ***LIB:*** *Li-ion battery;* ***MDP:*** *metal depletion;* ***MEP:*** *marine eutrophication;* **$METP_{inf}$:** *marine ecotoxicity;* ***NLTP:*** *natural land transformation;* **ODP_{inf}:** *ozone depletion;* ***OF:*** *oil filter;* ***PHEV:*** *plug-in hybrid electric vehicle;* ***PMFP:*** *particulate matter formation;* ***POFP:*** *photochemical ozone formation;* ***SIICEV:*** *spark-ignition (gasoline) internal combustion engine vehicle;* **TAP_{100}:** *terrestrial acidification;* **$TETP_{inf}$:** *terrestrial ecotoxicity;* ***TI:*** *tires;* ***ULOP:*** *urban land occupation;* ***WDP:*** *water depletion;* ***WWF:*** *windscreen wiper fluid;*

Part	**SIICEV**	**CIICEV**	**BEV**	**PHEV**
1. AC fluid (ACF)	75,000 km	75,000 km	75,000 km	75,000 km
2. Lead battery (LB)	75,000 km	75,000 km	75,000 km	75,000 km
3. Brake fluid (BF)	75,000 km	75,000 km	75,000 km	75,000 km
4. Cooling fluid (CF)	75,000 km	75,000 km	75,000 km	75,000 km
5. Windscreen washing fluid (WWF)	37,500 km	37,500 km	37,500 km	37,500 km
6. Drain (DR)	30,000 km	30,000 km	-	30,000 km
7. Oil filter (OF)	50,000 km	50,000 km	-	50,000 km
8. Tires (TI)	50,000 km	50,000 km	50,000 km	50,000 km
9. Li-Ion battery (LIB)	-	-	75,000 km	-
10. Car wash (CW)	17,000 km	17,000 km	17,000 km	17,000 km

Table S2.4.1: Maintenance frequencies of vehicles.

Impact	**ACF**	**LB**	**BF**	**CF**	**WWF**	**DR**	**OF**	**TI**	**LIB**	**CW**
ALOP (m^2.yr)	4.81E-4	5.07E-2	8.71E-2	4.81E-4	1.59E-3	1.80E-2	1.80E-2	5.58E-2	1.15E-1	0.00E+0
GWP_{100} (kg $CO_{2\text{-eq.}}$)	3.46E0	2.36E0	4.10E0	3.46E0	7.81E-1	1.26E+0	1.26E+0	3.24E+0	4.24E+0	0.00E+0
FDP (kg $oil_{\text{-eq.}}$)	7.41E-1	7.61E-1	1.89E0	7.41E-1	8.91E-1	1.90E+0	1.90E+0	1.91E+0	1.45E+0	0.00E+0
$FETP_{inf}$ (kg 1,4-$DCB_{\text{-eq.}}$)	2.75E-3	7.91E-2	4.37E-2	2.75E-3	2.67E-3	9.45E-3	9.45E-3	6.79E-2	4.14E-1	0.00E+0
FEP (kg $P_{\text{-eq.}}$)	8.07E-5	4.09E-3	2.77E-3	8.07E-5	1.02E-4	4.24E-4	4.24E-4	1.00E-3	1.98E-2	0.00E+0
HTP_{inf} (kg 1,4-$DCB_{\text{-eq.}}$)	5.53E-1	7.59E0	3.36E0	5.53E-1	8.30E-2	4.18E-1	4.18E-1	1.34E+0	3.67E+1	0.00E+0
IRP (kg $U^{235}{}_{\text{-eq.}}$)	1.29E-2	7.19E-1	1.99E0	1.29E-2	6.30E-2	2.90E-1	2.90E-1	3.68E-1	7.58E-1	0.00E+0
$METP_{inf}$ (kg 1,4-$DCB_{\text{-eq.}}$)	2.64E-3	7.60E-2	5.20E-2	2.64E-3	1.91E-3	1.03E-2	1.03E-2	6.93E-2	4.37E-1	0.00E+0
MEP (kg $N_{\text{-eq.}}$)	5.52E-3	3.06E-3	3.39E-3	5.52E-3	4.33E-4	1.52E-3	1.52E-3	2.67E-3	7.46E-3	0.00E+0
MDP (kg $Fe_{\text{-eq.}}$)	5.78E-3	9.10E-1	1.92E-1	5.78E-3	1.87E-2	8.75E-2	8.75E-2	2.58E+0	1.62E+1	0.00E+0
NLTP (m^2)	8.63E-6	3.32E-4	4.36E-4	8.36E-6	3.98E-4	2.60E-3	2.60E-3	4.82E-4	1.40E-3	0.00E+0
ODP_{inf} (kg $CFC11_{\text{-eq.}}$)	8.80E-5	1.88E-7	1.90E-6	8.80E-5	1.68E-7	6.77E-7	6.77E-7	5.27E-7	4.13E-7	0.00E+0
PMFP (kg $PM10_{\text{-eq.}}$)	9.15E-3	6.89E-3	4.96E-3	9.15E-3	4.53E-4	2.70E-3	2.70E-3	7.11E-3	1.66E-2	0.00E+0
POFP (kg $NMVOC_{\text{-eq.}}$)	1.69E-2	9.19E-3	1.22E-2	1.69E-2	1.72E-3	1.64E-2	1.64E-2	1.01E-2	2.17E-2	0.00E+0
TAP_{100} (kg $SO_{2\text{-eq.}}$)	2.10E-2	2.16E-2	1.47E-2	2.10E-2	1.30E-3	8.96E-3	8.96E-3	1.45E-2	4.25E-2	0.00E+0
$TETP_{inf}$ (kg 1,4-$DCB_{\text{-eq.}}$)	7.94E-5	2.13E-4	1.33E-3	7.94E-5	7.16E-5	4.28E-4	4.28E-4	3.53E-4	1.34E-3	0.00E+0
ULOP (m^2.yr)	1.10E-3	2.25E-2	1.90E-2	1.10E-3	2.27E-3	1.40E-2	1.40E-2	1.70E-2	1.17E-1	0.00E+0
WDP (m^3)	5.91E-3	1.87E0	6.66E-2	5.91E-3	2.08E-3	8.97E-3	8.97E-3	1.50E-2	4.42E-2	5.00E+1

Table S2.4.2: Potential impacts associated with spare parts and maintenance. Every impact is expressed in reference unit per kg of spare part, except car wash (10. CW) which is for the whole vehicle.

S2.5 Miscellanous

Glossary: ***FETP$_{inf}$:*** *freshwater ecotoxicity;* ***HTP$_{inf}$:*** *human toxicity;* ***METP$_{inf}$:*** *marine ecotoxicity;* ***PMFP:*** *particulate matter formation;* ***TETP$_{inf}$:*** *terrestrial ecotoxicity;*

Impact	FETP$_{inf}$ kg 1,4-DCB$_{-eq.}$	HTP$_{inf}$ kg 1,4-DCB$_{-eq.}$	METP$_{inf}$ kg 1,4-DCB$_{-eq.}$	PMFP Kg PM$_{10-eq.}$	TETP$_{inf}$ kg 1,4-DCB$_{-eq.}$
/ km	5.82E-6	7.55E-3	3.75E-4	4.67E-7	5.19E-7

Table S2.5.1: Non combustion impacts, kg per km. Impacts are the same for all vehicles and are linked with brake and tire wear and fluid emissions (i.e. windshield wiper fluid).

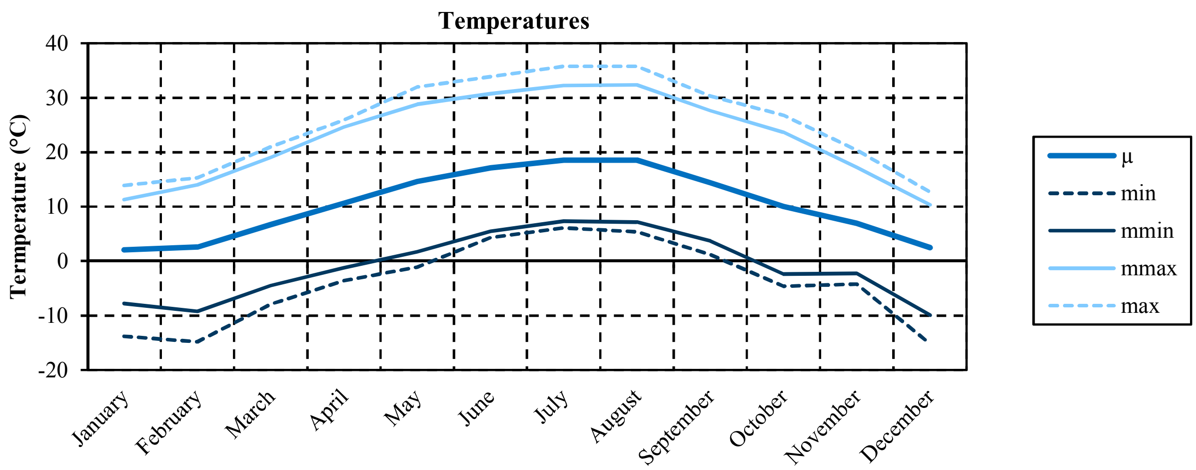


Figure S2.5.1: Temperature range in Luxembourg during one year.

S3. Vehicle end of life

Glossary: ***ALOP:*** *agricultural land occupation;* ***As:*** *arsenic;* ***Bra:*** *brass;* ***C black:*** *carbon black;* ***Ceram:*** *ceramics;* ***Chem:*** *various chemicals;* ***GWP$_{100}$:*** *global warming;* ***Elec:*** *electronic components;* ***EoL:*** *end of life;* ***FDP:*** *fossil depletion;* ***FETP$_{inf}$:*** *freshwater ecotoxicity;* ***FEP:*** *freshwater eutrophication;* ***G fibre:*** *glass fibre;* ***HTP$_{inf}$:*** *human toxicity;* ***IRP:*** *ionising radiations;* ***LiIon B:*** *lithium-ion battery;* ***METP$_{inf}$:*** *marine ecotoxicity;* ***MEP:*** *marine eutrophication;* ***MDP:*** *metal depletion;* ***Mg:*** *magnesium;* ***NLTP:*** *natural land transformation;* ***ODP$_{inf}$:*** *ozone depletion;* ***PMFP:*** *particulate matter formation;* ***POFP:*** *photochemical ozone formation;* ***Pt:*** *platinum;* ***Rh:*** *rhodium;* ***Sb:*** *antimony;* ***TAP$_{100}$:*** *terrestrial acidification;* ***TETP$_{inf}$:*** *terrestrial ecotoxicity;* ***Tire a:*** *tire additive;* ***ULOP:*** *urban land occupation;* ***WDP:*** *water depletion;* ***ZnO:*** *zinc oxide;*

Impact	Mg	Pt	Sb	Rh	As	Brass	Plastics	Paint	Fluids	Ceram.
ALOP (m^2.yr)	5.64E-4	1.13E-1	8.98E-3	1.13E-1	8.98E-3	2.46E-4	8.07E-4	3.10E-4	9.13E-4	2.46E-4
GWP$_{100}$ (kg $CO_{2-eq.}$)	3.41E-2	1.80E-1	2.42E+0	1.80E-1	2.42E+0	7.10E-3	2.35E+0	4.50E-2	2.81E+0	7.10E-3
FDP (kg oil$_{-eq.}$)	1.62E-2	6.29E-2	2.81E-1	6.29E-2	2.81E-1	4.52E-3	1.21E-2	7.07E-3	3.49E-1	4.52E-3
FETP$_{inf}$ (kg 1,4-DCB$_{-eq.}$)	3.77E-4	1.74E-3	1.39E-2	1.74E-3	1.39E-2	1.69E-5	1.14E-2	1.83E-4	1.29E-3	1.69E-5
FEP (kg P$_{-eq.}$)	3.52E-6	1.02E-4	7.95E-4	1.02E-4	7.95E-4	5.61E-7	2.30E-5	1.23E-6	1.25E-4	5.61E-7
HTP$_{inf}$ (kg 1,4-DCB$_{-eq.}$)	1.31E-2	6.55E-2	3.21E-1	6.55E-2	3.21E-1	6.65E-4	2.36E-1	9.03E-3	6.36E-2	6.65E-4
IRP (kg $U^{235}$$_{-eq.}$)	3.05E-3	1.68E-2	2.02E-1	1.68E-2	2.02E-1	6.55E-4	1.67E-2	2.17E-3	3.67E-2	6.55E-4
METP$_{inf}$ (kg 1,4-DCB-	3.28E-4	1.75E-3	1.39E-2	1.75E-3	1.39E-2	1.63E-5	9.48E-3	1.74E-4	1.31E-3	1.63E-5
MEP (kg N$_{-eq.}$)	2.13E-4	1.76E-4	7.83E-4	1.76E-4	7.83E-4	2.40E-5	3.05E-4	3.94E-5	4.53E-4	2.40E-5
MDP (kg Fe$_{-eq.}$)	2.37E-3	1.30E-1	2.97E-2	1.30E-1	2.97E-2	2.64E-4	3.21E-3	7.48E-4	1.30E-2	2.64E-4
NLTP (m^2)	-5.66E-5	3.07E-5	2.29E-4	3.07E-5	2.29E-4	-4.04E-5	4.95E-6	-4.38E-5	3.83E-4	-4.04E-5
ODP$_{inf}$ (kg CFC11$_{-eq.}$)	6.59E-9	4.95E-9	1.06E-7	4.95E-9	1.06E-7	2.13E-9	3.52E-9	3.10E-9	1.49E-7	2.13E-9
PMFP (kg PM10$_{-eq.}$)	1.58E-4	6.15E-4	9.09E-4	6.15E-4	9.09E-4	2.07E-5	1.75E-4	3.53E-5	6.66E-4	2.07E-5

POFP (kg NMVOC$_{-eq.}$)	6.75E-4	6.61E-4	2.17E-3	6.61E-4	2.17E-3	7.85E-5	6.90E-4	1.38E-4	1.82E-3	7.85E-5
TAP$_{100}$ (kg SO$_{2-eq.}$)	3.65E-4	6.17E-4	2.67E-3	6.17E-4	2.67E-3	4.41E-5	4.56E-4	7.37E-5	2.10E-3	4.41E-5
TETP$_{inf}$ (kg 1,4-DCB$_{-eq.}$)	3.54E-6	1.50E-5	9.37E-5	1.50E-5	9.37E-5	8.16E-7	4.65E-5	1.44E-6	6.69E-5	8.16E-7
ULOP (m².yr)	3.99E-3	2.65E-3	4.96E-3	2.65E-3	4.96E-3	9.97E-4	3.74E-4	3.75E-3	1.76E-3	9.97E-4
WDP (m³)	1.46E-3	1.56E-3	8.99E-3	1.56E-3	8.99E-3	1.71E-4	1.38E-3	2.88E-4	5.80E-3	1.71E-4

Impact	Glass	C black	ZnO	Tire a.	G. fibre	Chem.	Elec.	LiIon b.	Other
ALOP (m².yr)	2.46E-4	1.13E-1	8.98E-3	8.98E-3	3.71E-4	2.34E-3	8.71E-4	1.87E-2	8.98E-3
GWP$_{100}$ (kg CO$_{2-eq.}$)	7.10E-3	1.80E-1	2.42E+00	2.42E+00	2.44E-2	1.98E+00	1.08E+00	9.31E-1	2.42E+00
FDP (kg oil$_{-eq.}$)	4.52E-3	6.29E-2	2.81E-1	2.81E-1	1.12E-2	7.52E-2	2.88E-2	1.80E-1	2.81E-1
FETP$_{inf}$ (kg 1,4-DCB$_{-eq.}$)	1.69E-5	1.74E-3	1.39E-2	1.39E-2	1.45E-4	8.61E-2	7.90E-2	9.76E-3	1.39E-2
FEP (kg P$_{-eq.}$)	5.61E-7	1.02E-4	7.95E-4	7.95E-4	2.69E-6	3.05E-4	3.52E-5	5.08E-4	7.95E-4
HTP$_{inf}$ (kg 1,4-DCB$_{-eq.}$)	6.65E-4	6.55E-2	3.21E-1	3.21E-1	1.37E-2	8.56E-2	9.74E-1	4.94E-1	3.21E-1
IRP (kg U$^{235}_{-eq.}$)	6.55E-4	1.68E-2	2.02E-1	2.02E-1	2.15E-3	4.82E-2	2.40E-2	3.68E-1	2.02E-1
METP$_{inf}$ (kg 1,4-DCB$_{-}$	1.63E-5	1.75E-3	1.39E-2	1.39E-2	1.37E-4	1.33E-2	3.99E-2	9.66E-3	1.39E-2
MEP (kg N$_{-eq.}$)	2.40E-5	1.76E-4	7.83E-4	7.83E-4	1.82E-4	4.38E-4	3.37E-4	7.73E-4	7.83E-4
MDP (kg Fe$_{-eq.}$)	2.64E-4	1.30E-1	2.97E-2	2.97E-2	1.96E-3	8.77E-3	4.70E-3	5.58E-2	2.97E-2
NLTP (m²)	-4.04E-5	3.07E-5	2.29E-4	2.29E-4	-3.43E-05	5.34E-5	2.17E-5	8.48E-5	2.29E-4
ODP$_{inf}$ (kg CFC11$_{-eq.}$)	2.13E-9	4.95E-9	1.06E-7	1.06E-7	4.48E-9	2.74E-8	1.05E-8	4.59E-8	1.06E-7
PMFP (kg PM10$_{-eq.}$)	2.07E-5	6.15E-4	9.09E-4	9.09E-4	1.32E-4	3.51E-4	2.31E-4	2.20E-3	9.09E-4
POFP (kg NMVOC$_{-eq.}$)	7.85E-5	6.61E-4	2.17E-3	2.17E-3	5.76E-4	9.26E-4	8.41E-4	2.52E-3	2.17E-3
TAP$_{100}$ (kg SO$_{2-eq.}$)	4.41E-5	6.17E-4	2.67E-3	2.67E-3	3.08E-4	9.11E-4	5.66E-4	8.42E-3	2.67E-3
TETP$_{inf}$ (kg 1,4-DCB$_{-eq.}$)	8.16E-7	1.50E-5	9.37E-5	9.37E-5	2.43E-6	1.49E-3	8.09E-4	7.62E-5	9.37E-5
ULOP (m².yr)	9.97E-4	2.65E-3	4.96E-3	4.96E-3	2.50E-3	1.61E-3	8.96E-4	4.86E-3	4.96E-3
WDP (m³)	1.71E-4	1.56E-3	8.99E-3	8.99E-3	1.32E-3	5.58E-3	8.60E-4	1.27E-2	8.99E-3

Table S3.1: Potential impacts of material end of life. EoL impacts of metals that are highly recycled (steel, aluminium, etc.) are included in car production and therefore not presented here

S4. Miscellanous

Glossary: ***A:*** *mini car;* ***B:*** *small car;* ***BEV:*** *battery-powered electric vehicle;* ***C:*** *medium car;* ***cons°:*** *consumption;* ***D:*** *large car;* ***E:*** *executive car;* ***J:*** *sport-utility vehicle;* ***M:*** *multipurpose car;* ***NEDC:*** *new European driving cycle;* ***PHEV:*** *plug-in hybrid electric vehicle;* ***U:*** *utility vehicle;*

Vehicle	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10
Segment	B	A	D	B	A	U	C	J	M	E
Price (€)	30,190	29,500	26,100	20,800	19,500	20,344	36,000	38,250	30,000	71,700
Price/month (€)	0	0	82	80	65	80	0	0	0	0
NEDC cons° (kWh /km)	15.9	9.2	13.8	12.2	14.0	15.0	16.2	20.3	14.5	19.7
NEDC range (km)	175	150	185	210	145	170	190	200	200	502
Battery (kWh)	27.9	13.8	25.6	25.6	20.3	25.6	30.8	40.7	29.1	90.0
Full charge (h)	6	6	6	6	6	6	6	6	6	8
Urban cons° (kWh /km)	19.6	14.4	18.5	18.8	13.6	17.7	19.7	24.4	20.5	28.8
Road cons° (kWh /km)	15.4	12.6	14.9	14.8	13.2	15.8	15.5	19.2	15.7	19.8
Highway cons° (kWh /km)	21.9	20.0	21.6	21.2	22.9	25.4	21.8	27.0	21.9	24.0
Available year	2013	2013	2011	2012	2012	2013	2015	2016	2016	2014

Table S4.1.1: BEV characteristics. (Urban, Road and Highway cons° correspond to B-coefficients as described in section 2.3)

Vehicle	V1	V2	V3	V4	V5	V6	V7	V8	V9
Segment	C	D	B	E	G	A	U	D	M
Price (€)	35000	40000	30000	45000	45000	28000	30000	40000	38000
Price/month	0	0	0	0	0	0	0	0	0

NEDC cons°	12.5	20.0	10.5	16.5	17.5	10.0	14.5	14.5	14.5
Range (km)	23	60	50	50	50	50	50	50	50
Battery (kWh)	4.4	10.0	3.9	4.9	5.4	3.4	4.9	4.9	4.9
Full charge (h)	1.5	4.0	3	3	3	3	3	3	3
Urban cons°(kWh)	17.4	22.8	18.0	21.9	21.3	16.0	20.1	20.7	20.4
Road cons°(kWh)	12.1	14.7	13.3	14.1	15.4	13.2	15.3	14.0	14.7
Highway cons (kWh)	15.3	18.0	18.5	17.4	20.0	19.7	20.6	18.1	19.6
Available year	2013	2013	2014	2015	2014	2014	2015	2014	2015
Urban fuel cons° (1)	7.7	9.0	6.4	8.8	8.4	6.7	7.9	7.9	8.1
Road fuel cons° (1)	5.5	6.6	5.2	6.6	6.9	5.4	6.6	6.1	6.4
Highway fuel cons° (1)	7.7	8.9	8.0	8.9	10.6	9.0	10.4	8.8	9.7
Urban fuel cons° (2)	0.08	0	0.02	0.3	0.2	0.01	0.1	0.2	0.1
Road fuel cons° (2)	0.3	0	0.2	0.7	0.6	0.1	0.5	0.5	0.5
Highway fuel cons° (2)	0.9	0	0.6	1.2	1.6	0.6	1.4	1.0	1.2

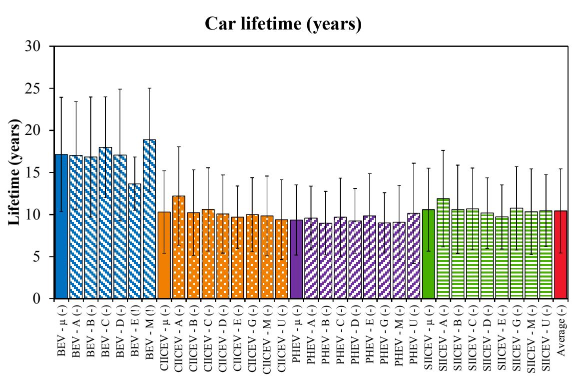
Table S4.1.2: PHEV characteristics. (Urban, Road and Highway cons° correspond to B-coefficients, when battery is empty (1) or full (2), as described in section 2.3)

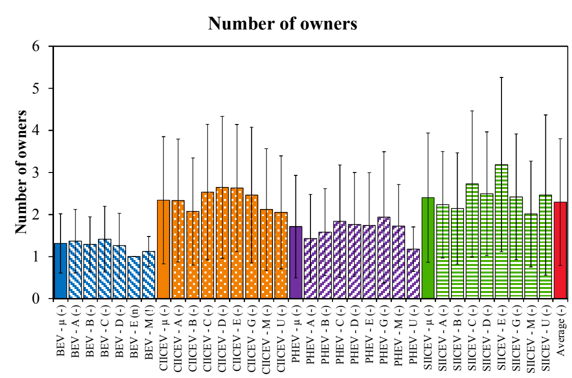
S5. Additional results

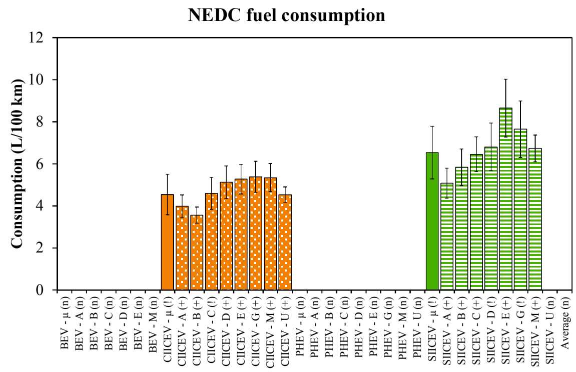
All following figures are presented following the same template. They provide additional figures (for scenario 3. Default) relevant to car characteristics and their potential impacts along their life cycle. Results are presented along with their standard variation, when applicable. Coefficients of variation are also presented in brackets following the horizontal axis labels. Coefficient variation can be (+) (c_v<16%, which means that the average is robust), (!) (16%<c_v<33%, which means that there might be some errors with the average and results have to be cautiously analyzed), (-) (c_v>33%, which means that the average is not robust and therefore the actual average could be anywhere between higher and lower standard deviations) or (n) (not enough cars to build a robust variation coefficient). Results are shown for BEVs (blue, left diagonal hatching), CIICEVs (orange, dots), PHEVs (purple, right diagonal hatching) and SIICEVs (green, horizontal hatching). All these results can be found in the supplementary materials spreadsheet. Do not hesitate to contact florent.querini@tudor.lu or enrico.benetto@tudor.lu for any information you may need.

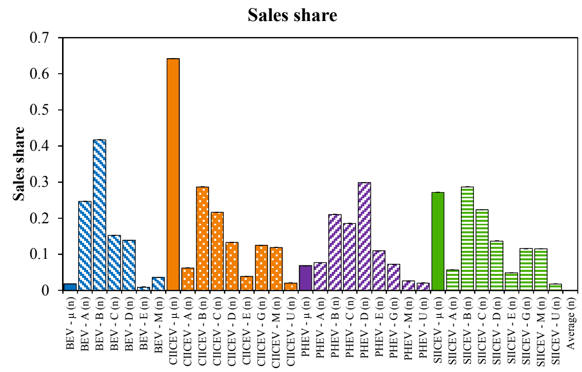
S5.1 FU details, per car segment

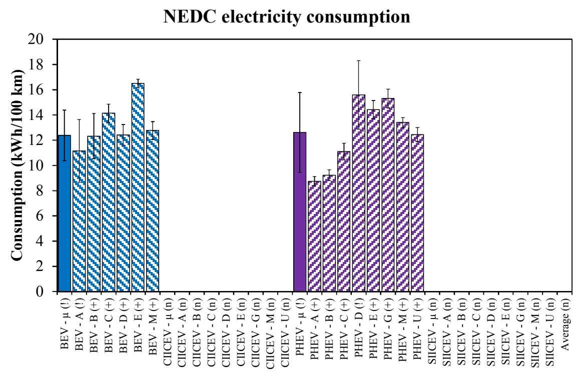
Glossary: ***A:*** *mini car;* ***B:*** *small car;* ***BEV:*** *battery-powered electric vehicle;* ***C:*** *medium car;* ***CIICEV:*** *compression-ignition (diesel) internal combustion engine vehicle;* ***D:*** *large car;* ***E:*** *executive car;* ***J:*** *sport-utility vehicle;* ***M:*** *multipurpose car;* ***NEDC:*** *new European driving cycle;* ***PHEV:*** *plug-in hybrid electric vehicle;* ***SIICEV:*** *spark-ignition (gasoline) internal combustion engine vehicle;* ***U:*** *utility vehicle;* ***µ:*** *average;*





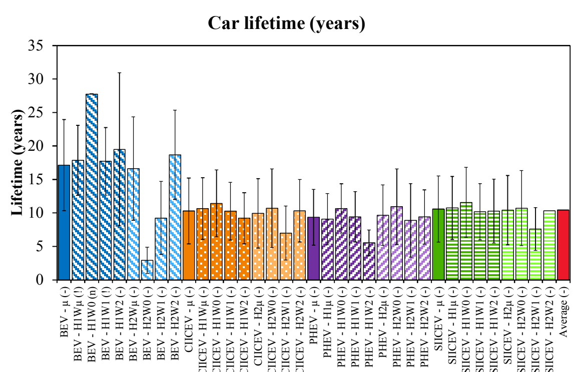


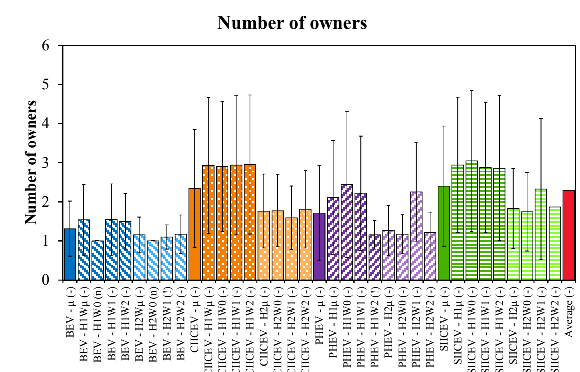


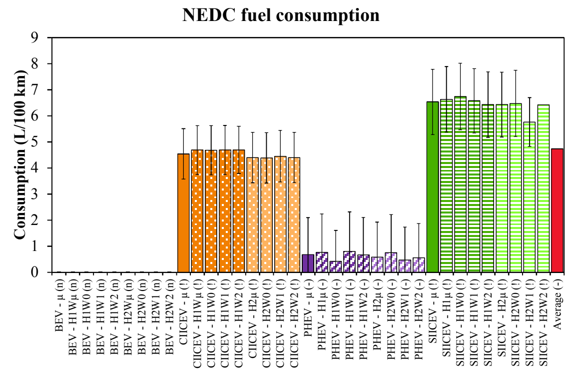


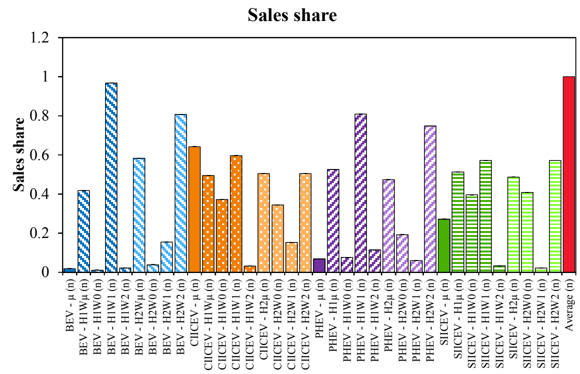
S5.2 FU details, depending on 1st owner location

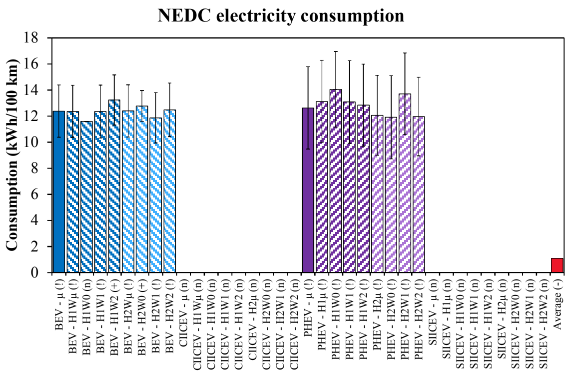
Glossary: ***BEV:*** *battery-powered electric vehicle;* ***CIICEV:*** *compression-ignition (diesel) internal combustion engine vehicle;* ***H1Wµ:*** *average Luxembourgish first owner;* ***H1W0:*** *Luxembourgish 1st owner, not working;* ***H1W1:*** *Luxembourgish 1st owner, working in Luxembourg;* ***H1W2:*** *crossborder Luxembourgish 1st owner, working in Lorraine;* ***H2Wµ:*** *average Lorraine first owner;* ***H2W0:*** *Lorraine 1st owner, not working;* ***H2W1:*** *crossborder Lorraine 1st owner, working in Luxembourg;* ***H2W2:*** *Lorraine 1st owner, working in Lorraine;* ***NEDC:*** *new European driving cycle;* ***PHEV:*** *plug-in hybrid electric vehicle;* ***SIICEV:*** *spark-ignition (gasoline) internal combustion engine vehicle;* ***µ:*** *average;*





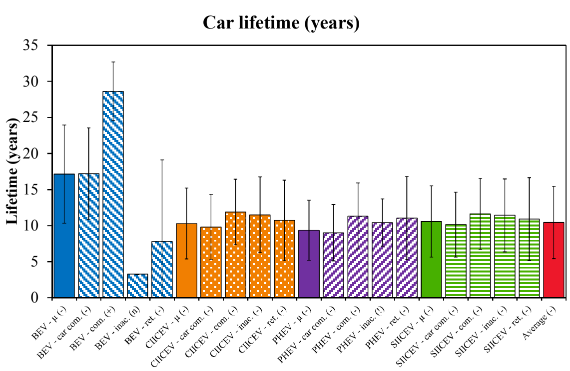


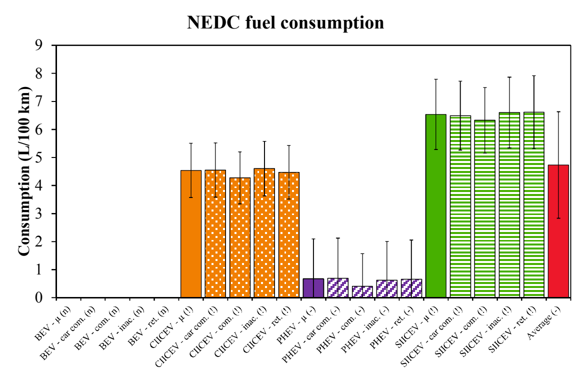


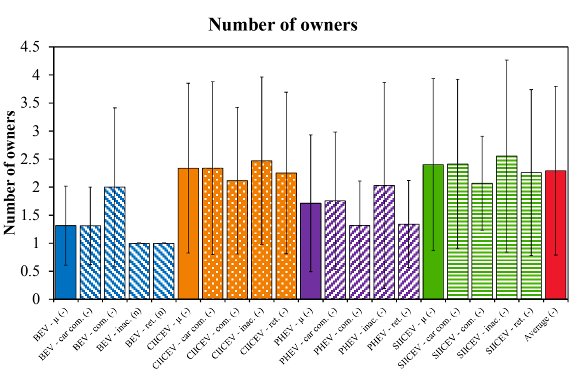


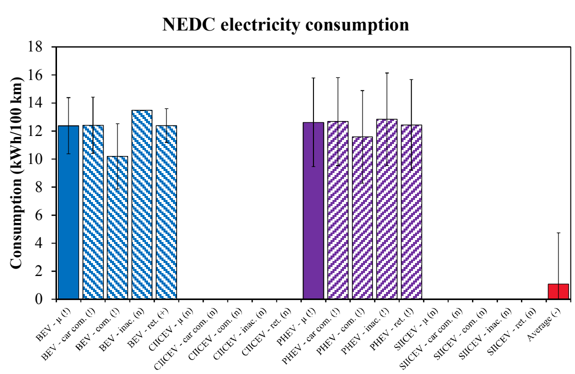
S5.3 FU details, depending on 1^st owner status

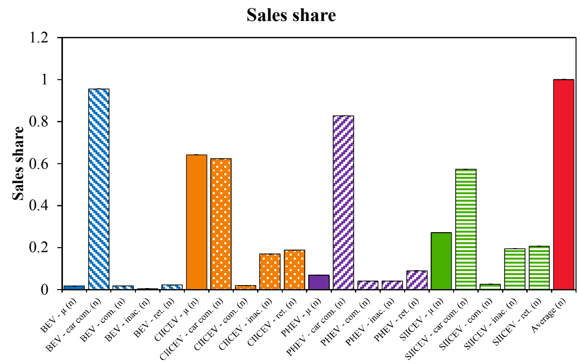
Glossary: ***BEV:*** *battery-powered electric vehicle;* ***car com:*** *worker using his/her car to go to work;* ***CIICEV:*** *compression-ignition (diesel) internal combustion electric vehicle;* ***com:*** *worker not using his/her car to go to work;* ***inac:*** *18-64 yrs. old individual not working;* ***NEDC:*** *new European driving cycle;* ***PHEV:*** *plug-in hybrid electric vehicle;* ***ret:*** *retired individual;* ***SIICEV:*** *spark-ignition electric vehicle;* ***μ:*** *average;*





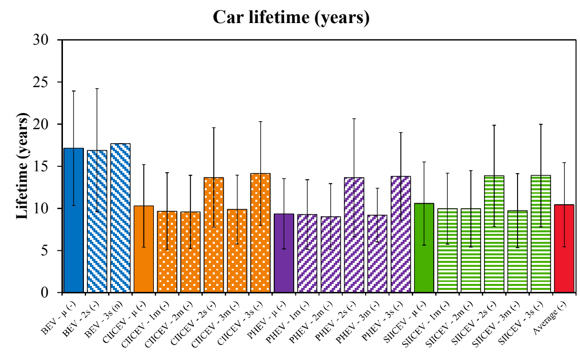


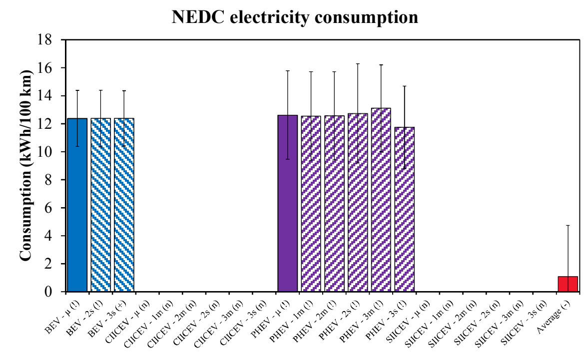


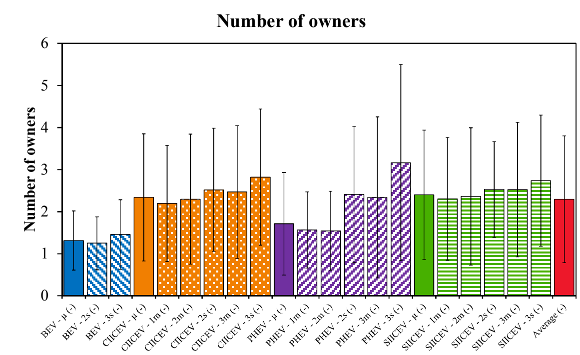


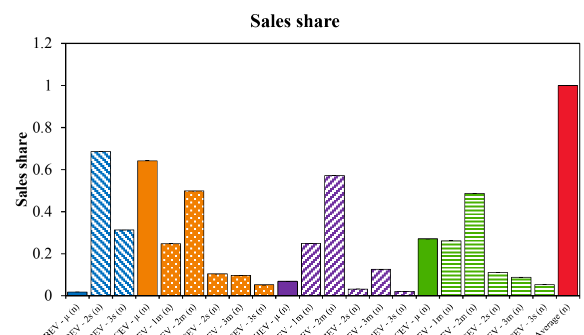
S5.4 FU details, depending on 1st owner household

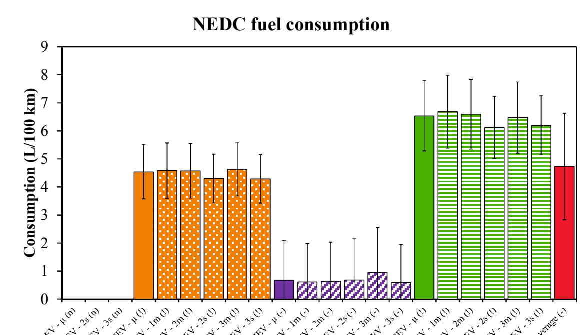
Glossary: ***1m:*** *single individual;* ***2m:*** *main car of couple household;* ***2s:*** *second car of couple household;* ***3m:*** *main car of 3-person household;* ***3s:*** *second or third car of 3-person household;* ***BEV:*** *battery-powered electric vehicle;* ***CIICEV:*** *compression-ignition (diesel) internal combustion engine vehicle;* ***NEDC:*** *new European driving cycle;* ***PHEV:*** *plug-in hybrid electric vehicle;* ***SIICEV:*** *spark-ignition (gasoline) internal combustion engine vehicle;* ***μ:*** *average;*





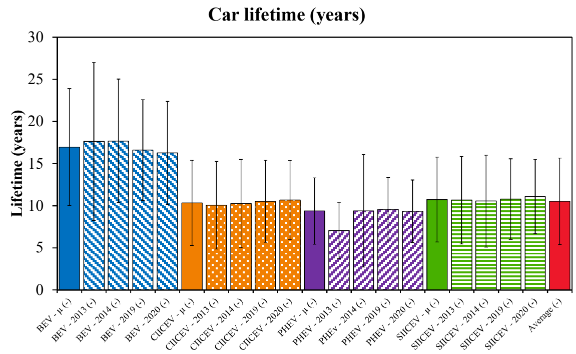


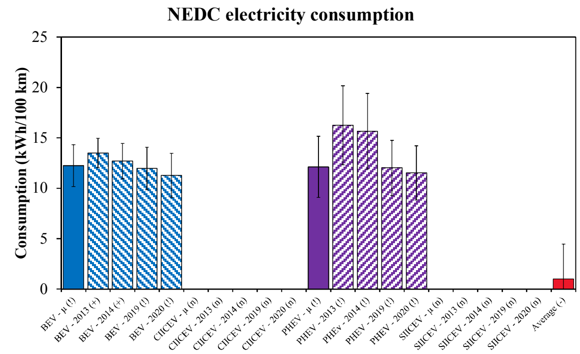


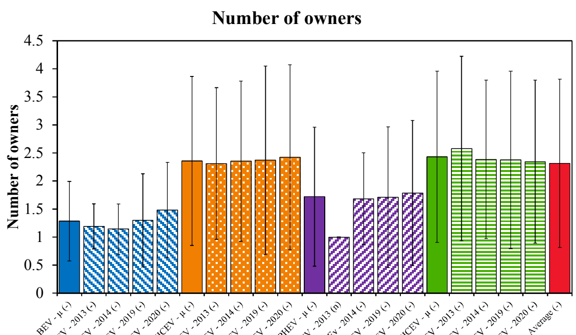


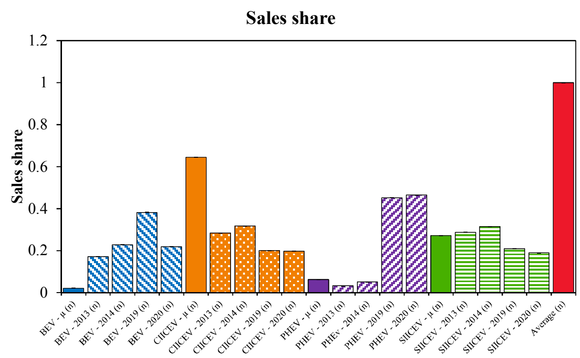
S5.5 FU details, depending on purchase year

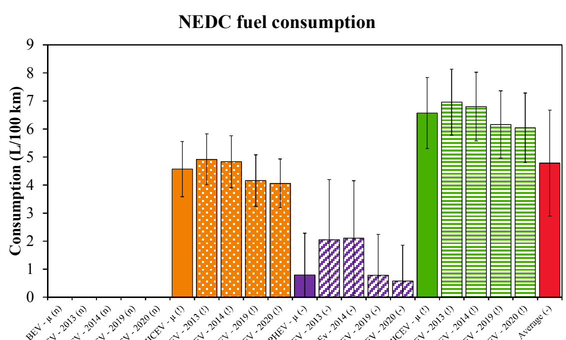
Glossary: ***BEV:*** *battery-powered electric vehicle;* ***CIICEV:*** *compression-ignition (diesel) internal combustion engine vehicle;* ***NEDC:*** *new European driving cycle;* ***PHEV:*** *plug-in hybrid electric vehicle;* ***SIICEV:*** *spark-ignition (gasoline) internal combustion engine vehicle;* ***μ:*** *average;*





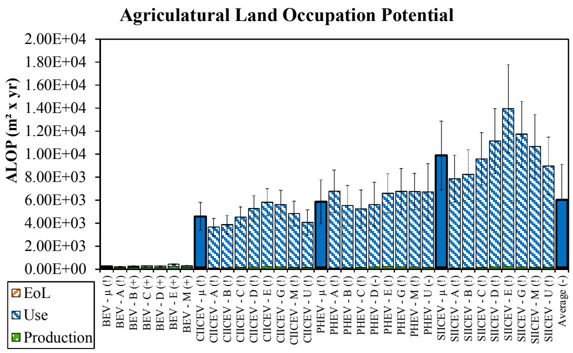


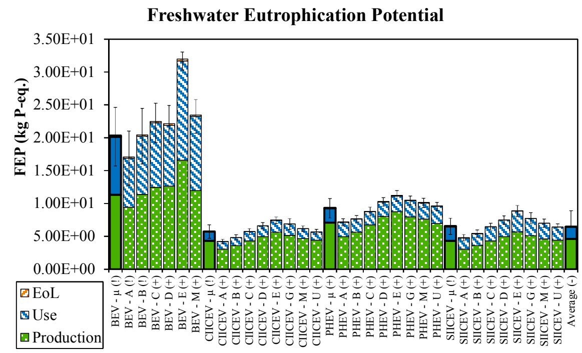


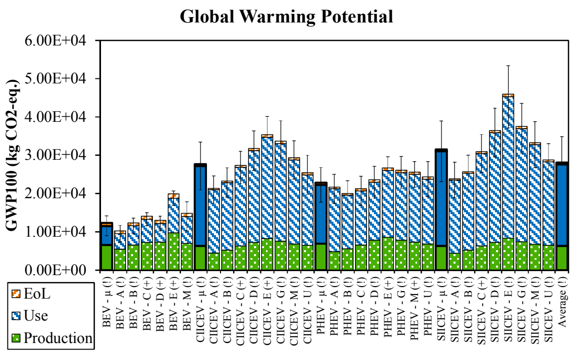


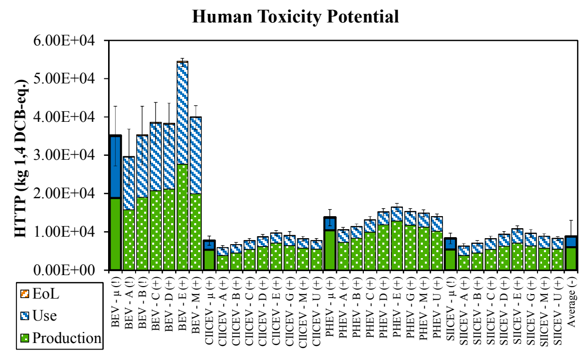
S5.6 Impacts per vehicle, per car segment

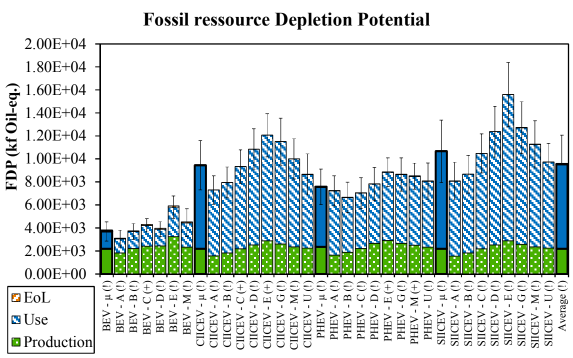
Glossary: ***A:*** *mini car;* ***B:*** *small car;* ***BEV:*** *battery-powered electric vehicle;* ***C:*** *medium car;* ***CIICEV:*** *compression-ignition (diesel) internal combustion engine vehicle;* ***D:*** *large car;* ***E:*** *executive car;* ***EoL:*** *end of life;* ***J:*** *sport-utility vehicle;* ***M:*** *multipurpose car;* ***NEDC:*** *new European driving cycle;* ***PHEV:*** *plug-in hybrid electric vehicle;* ***SIICEV:*** *spark-ignition (gasoline) internal combustion engine vehicle;* ***U:*** *utility vehicle;* ***μ:*** *average;*

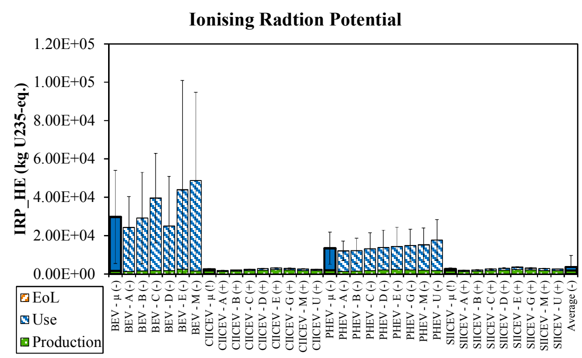

Agriculatural Land Occupation Potential
ALOP (m² x yr)
EoL
Use
Production

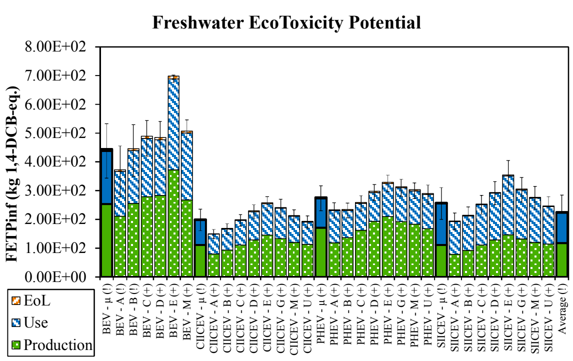

Freshwater Eutrophication Potential
FEP (kg P-eq.)
EoL
Use
Production

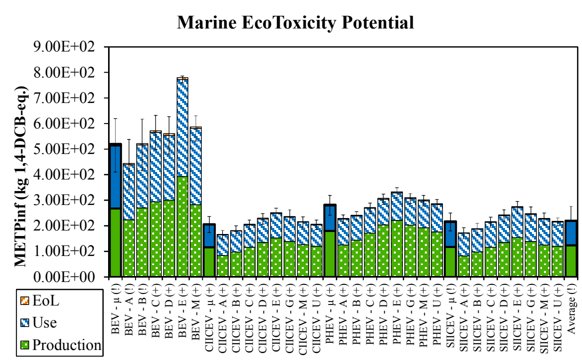

Global Warming Potential
GWP100 (kg CO2-eq.)
EoL
Use
Production

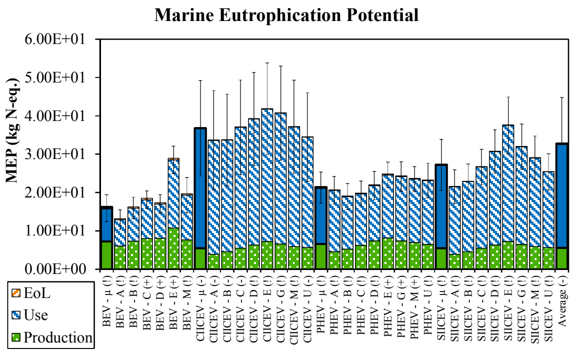

Human Toxicity Potential
HTTP (kg 1,4 DCB-eq.)
EoL
Use
Production

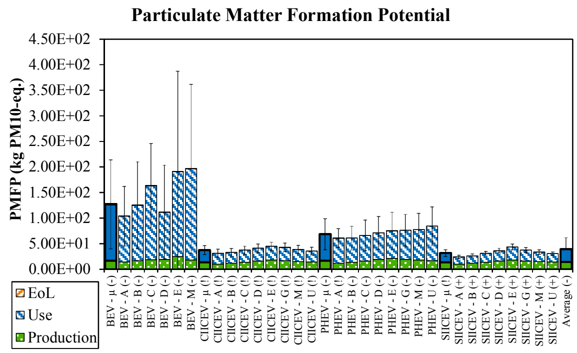

Fossil ressource Depletion Potential
FDP (kf Oil-eq.)
EoL
Use
Production

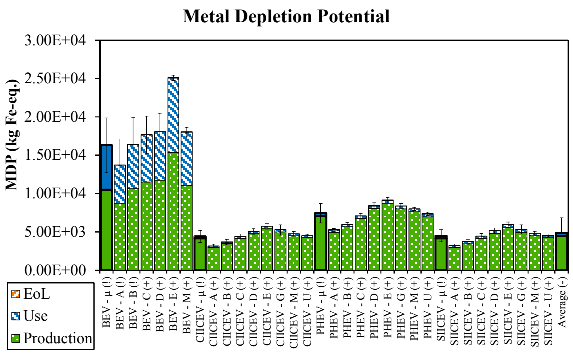

Ionising Radtion Potential
IRP_HE (kg U235-eq.)
EoL
Use
Production

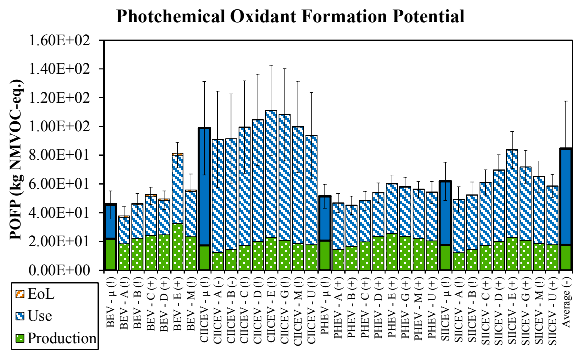

Freshwater EcoToxicity Potential
FETPinf (kg 1,4-DCB-eq.)
EoL
Use
Production

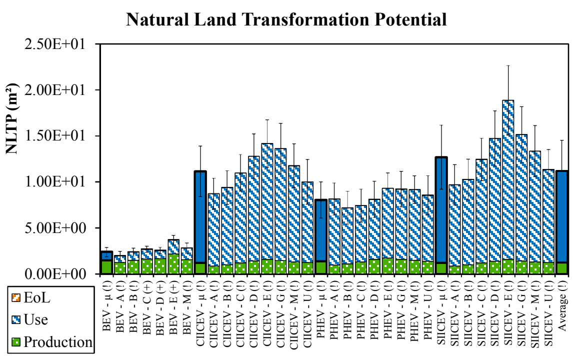

Marine EcoToxicity Potential
METPinf (kg 1,4-DCB-eq.)
EoL
Use
Production

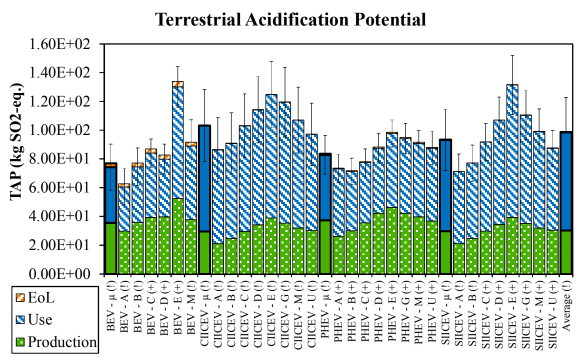

Marine Eutrophication Potential
MEP (kg N-eq.)
EoL
Use
Production

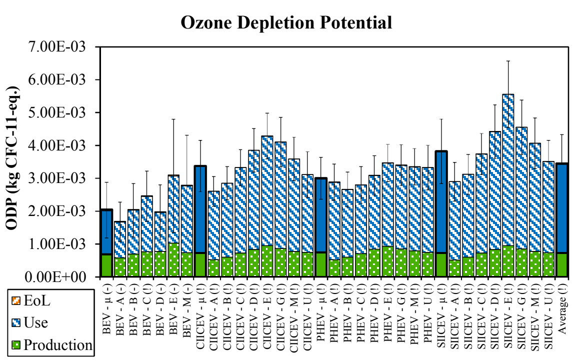

Particulate Matter Formation Potential
PMFP (kg PM10-eq.)
EoL
Use
Production

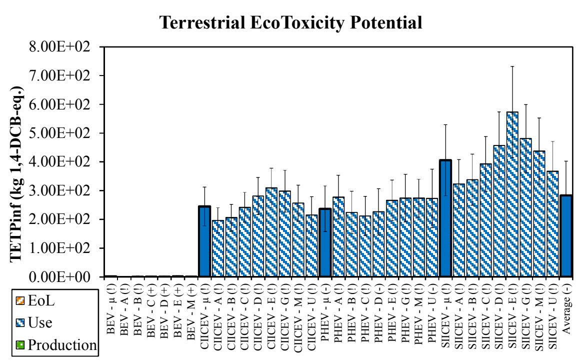

Metal Depletion Potential
MDP (kg Fe-eq.)
EoL
Use
Production

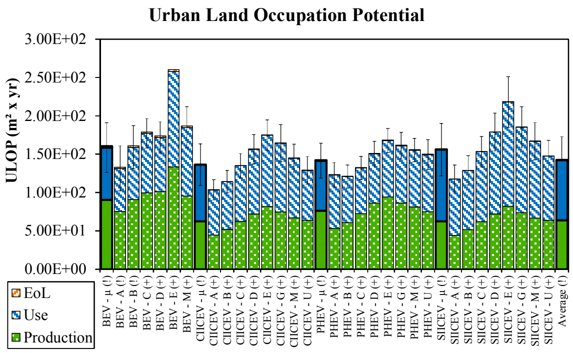

Photchemical Oxidant Formation Potential
POFP (kg NMVOC-eq.)
EoL
Use
Production

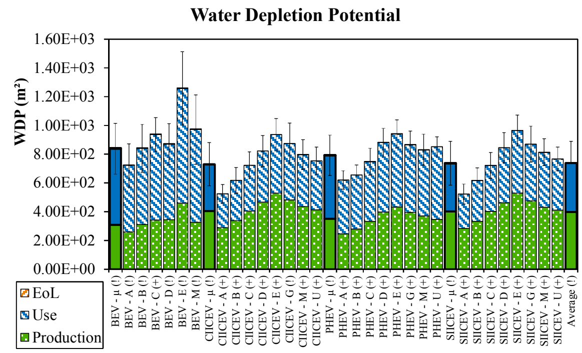

Natural Land Transformation Potential
NLTP (m²)
EoL
Use
Production


Terrestrial Acidification Potential
TAP (kg SO2-eq.)
EoL
Use
Production


Ozone Depletion Potential
ODP (kg CFC-11-eq.)
EoL
Use
Production

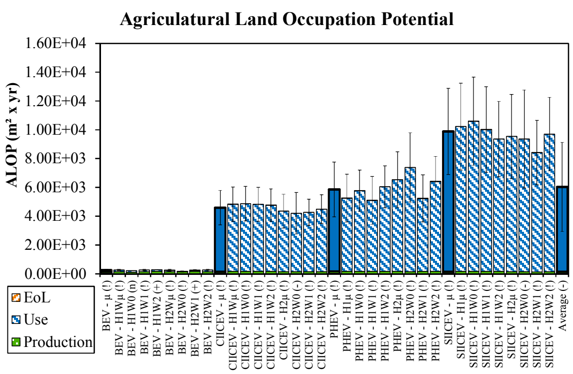

Terrestrial EcoToxicity Potential
TETPinf (kg 1,4-DCB-eq.)
EoL
Use
Production

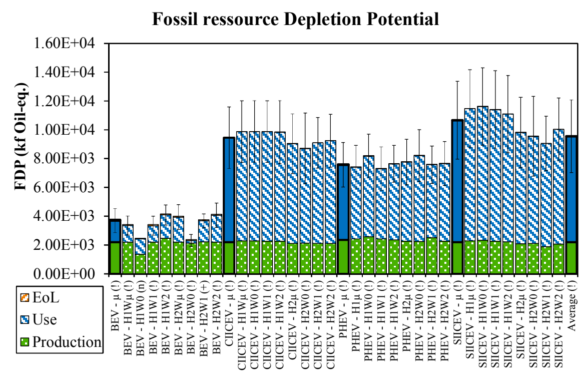


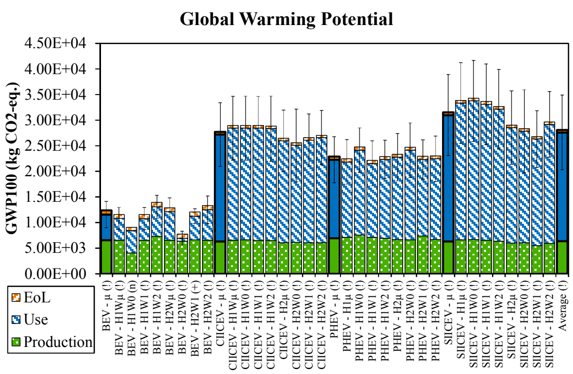


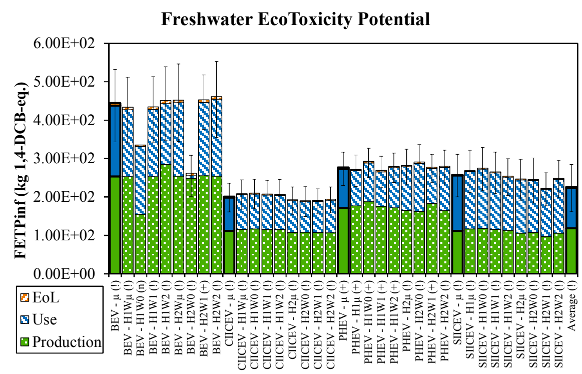
S5.7Impacts per vehicle, per 1^st owner location

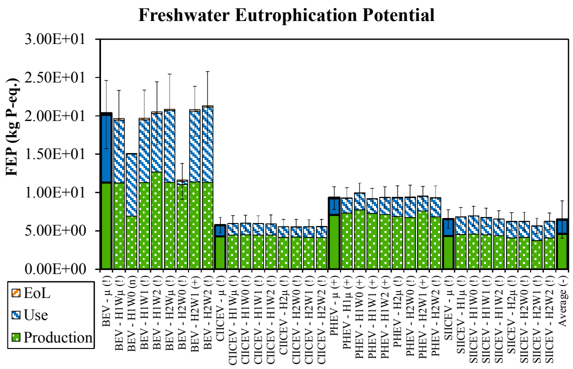
Glossary: ***BEV:*** *battery-powered electric vehicle;* ***CIICEV:*** *compression-ignition (diesel) internal combustion engine vehicle;* ***H1Wμ:*** *average Luxembourgish first owner;* ***H1W0:*** *Luxembourgish 1^st owner, not working;* ***H1W1:*** *Luxembourgish 1^st owner, working in Luxembourg;* ***H1W2:*** *crossborder Luxembourgish 1^st owner, working in Lorraine;* ***H2Wμ:*** *average Lorraine first owner;* ***H2W0:*** *Lorraine 1^st owner, not working;* ***H2W1:*** *crossborder Lorraine 1^st owner, working in Luxembourg;* ***H2W2:*** *Lorraine 1^st owner, working in Lorraine;* ***NEDC:*** *new European driving cycle;* ***PHEV:*** *plug-in hybrid electric vehicle;* ***SIICEV:*** *spark-ignition (gasoline) internal combustion engine vehicle;* ***μ:*** *average;*

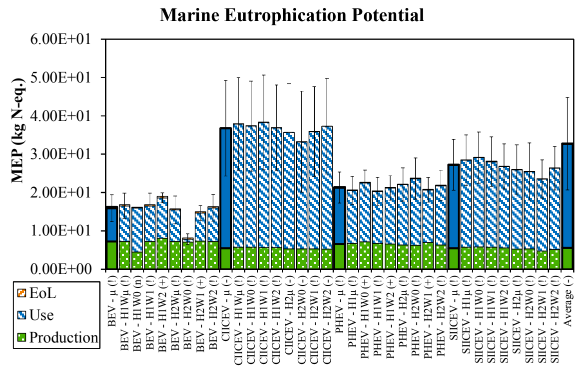


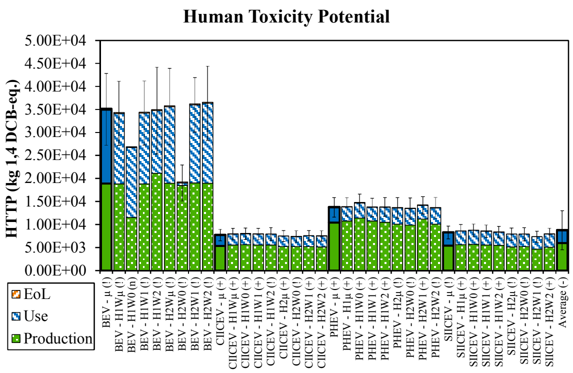


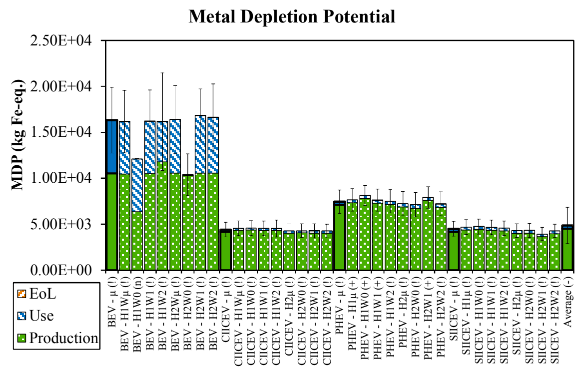


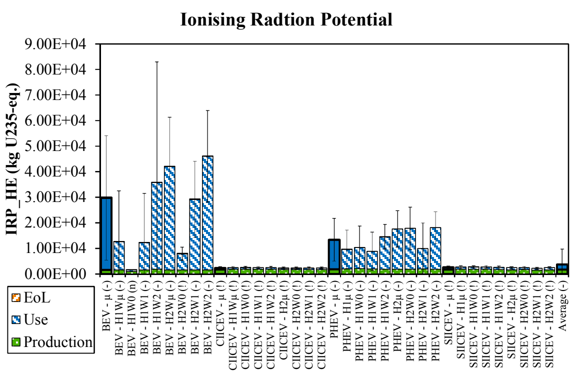


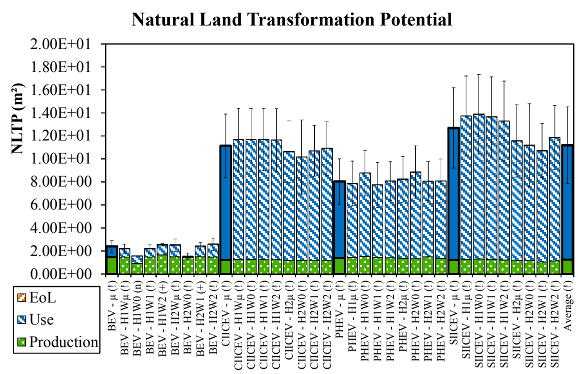

Freshwater Eutrophication Potential
FEP (kg P-eq.)
3.00E+01
2.50E+01
2.00E+01
1.50E+01
1.00E+01
5.00E+00
0.00E+00
EoL
Use
Production

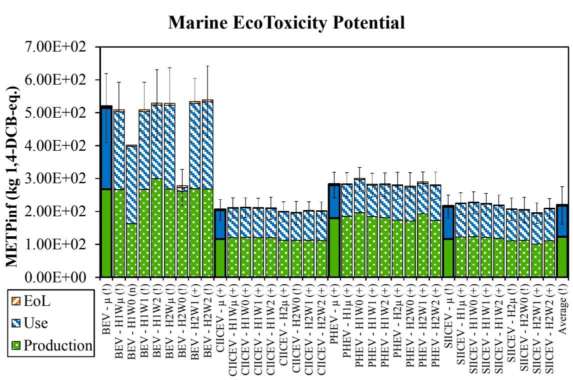

Marine Eutrophication Potential
MEP (kg N-eq.)
6.00E+01
5.00E+01
4.00E+01
3.00E+01
2.00E+01
1.00E+01
0.00E+00
EoL
Use
Production

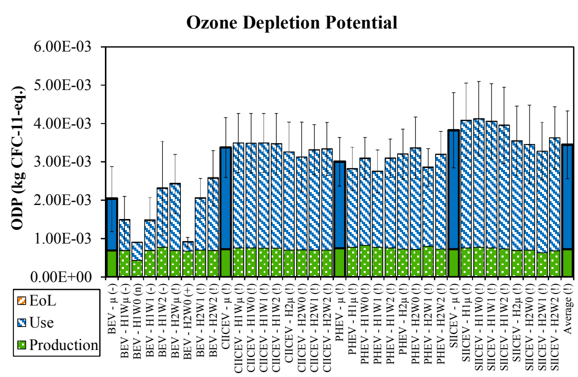

Human Toxicity Potential
HTTP (kg 1,4 DCB-eq.)
5.00E+04
4.50E+04
4.00E+04
3.50E+04
3.00E+04
2.50E+04
2.00E+04
1.50E+04
1.00E+04
5.00E+03
0.00E+00
EoL
Use
Production

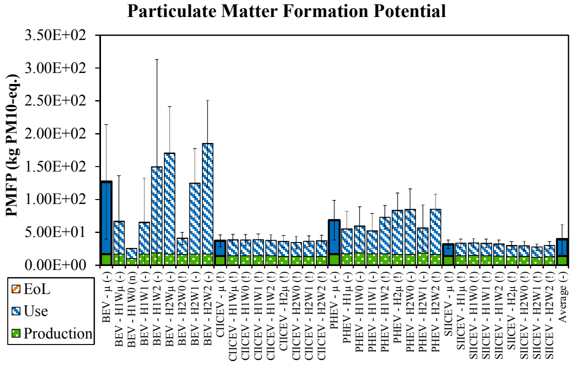

Metal Depletion Potential
MDP (kg Fe-eq.)
2.50E+04
2.00E+04
1.50E+04
1.00E+04
5.00E+03
0.00E+00
EoL
Use
Production

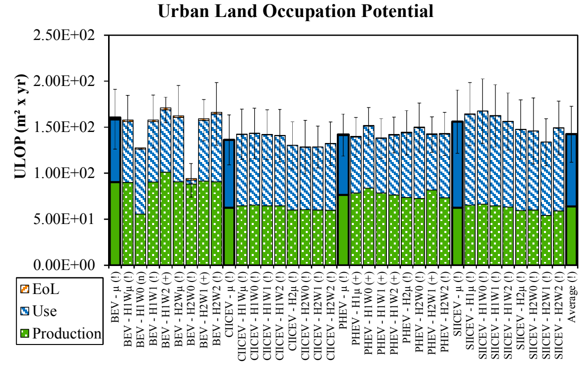

Ionising Radtion Potential
IRP_HE (kg U235-eq.)
9.00E+04
8.00E+04
7.00E+04
6.00E+04
5.00E+04
4.00E+04
3.00E+04
2.00E+04
1.00E+04
0.00E+00
EoL
Use
Production

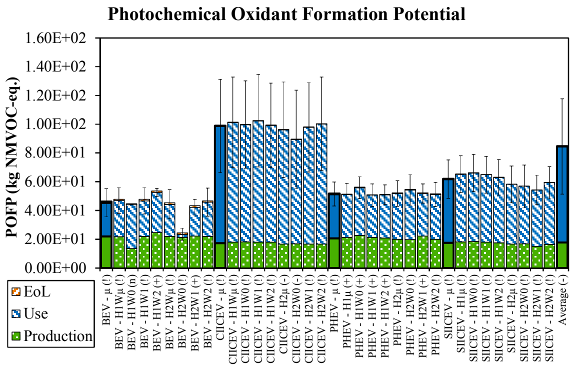

Natural Land Transformation Potential
NLTP (m²)
2.00E+01
1.80E+01
1.60E+01
1.40E+01
1.20E+01
1.00E+01
8.00E+00
6.00E+00
4.00E+00
2.00E+00
0.00E+00
EoL
Use
Production

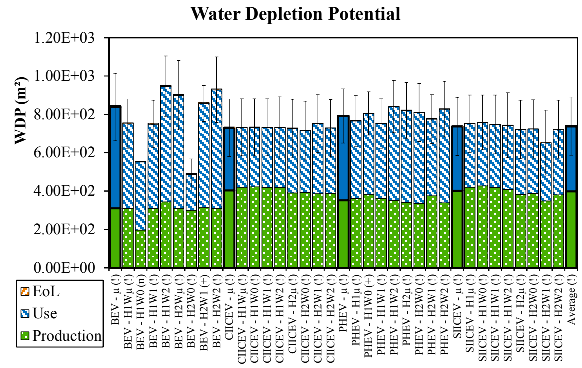

Marine EcoToxicity Potential
METPinf (kg 1,4-DCB-eq.)
7.00E+02
6.00E+02
5.00E+02
4.00E+02
3.00E+02
2.00E+02
1.00E+02
0.00E+00
EoL
Use
Production

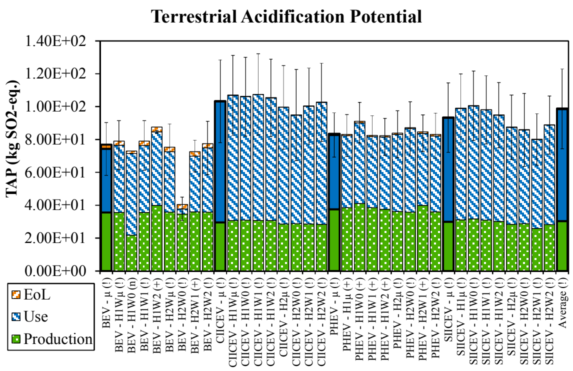

Ozone Depletion Potential
ODP (kg CFC-11-eq.)
6.00E-03
5.00E-03
4.00E-03
3.00E-03
2.00E-03
1.00E-03
0.00E+00
EoL
Use
Production

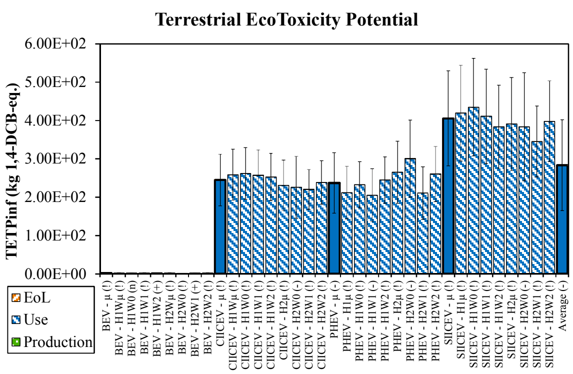






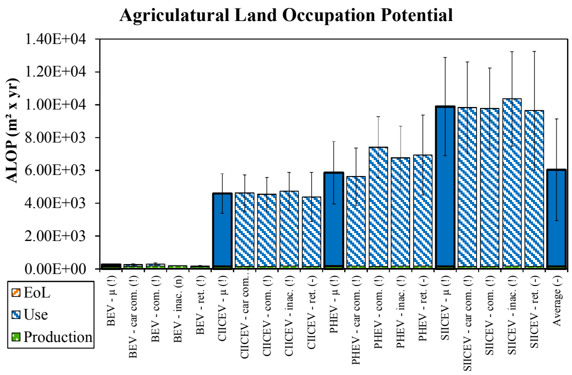


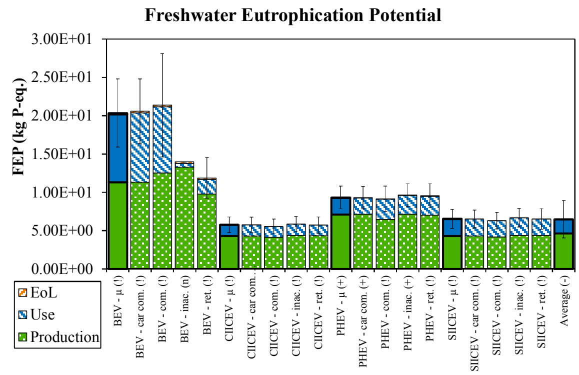


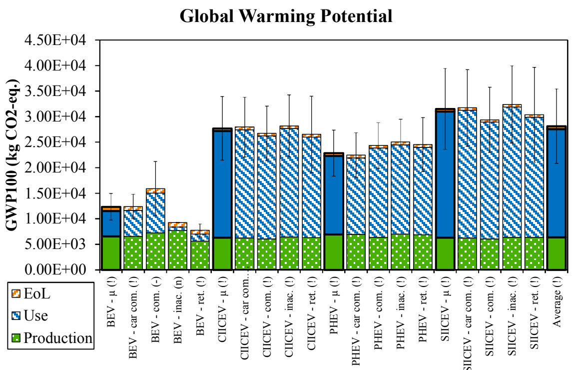


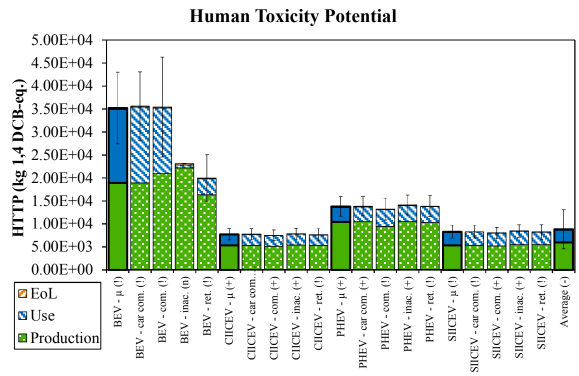
S5.8Impacts per vehicle, per 1st owner status

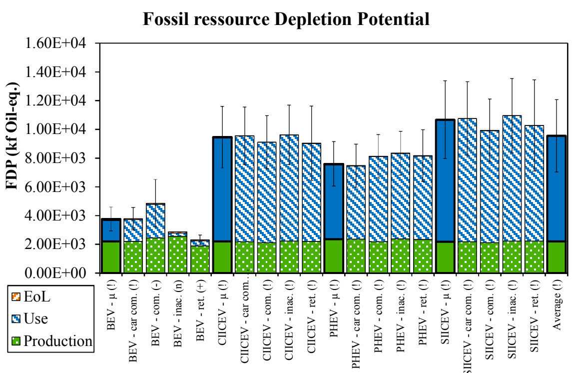
Glossary: **BEV:** *battery-powered electric vehicle;* **car com:** *worker using his/her car to go to work;* **CIICEV:** *compression-ignition (diesel) internal combustion electric vehicle;* **com:** *worker not using his/her car to go to work;* **inac:** *18-64 yrs. old individual not working;* **NEDC:** *new European driving cycle;* **PHEV:** *plug-in hybrid electric vehicle;* **ret:** *retired individual;* **SIICEV:** *spark-ignition electric vehicle;* **μ:** *average;*

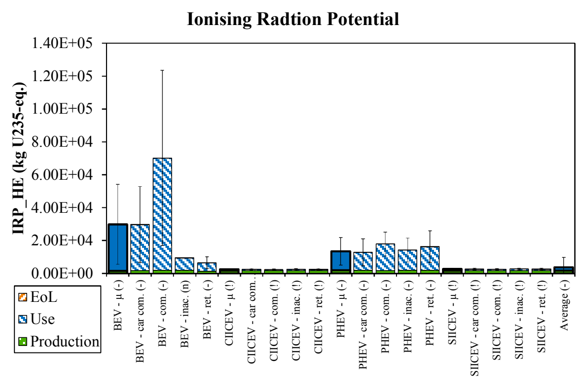

Agriculatural Land Occupation Potential
ALOP (m² x yr)
EoL
Use
Production

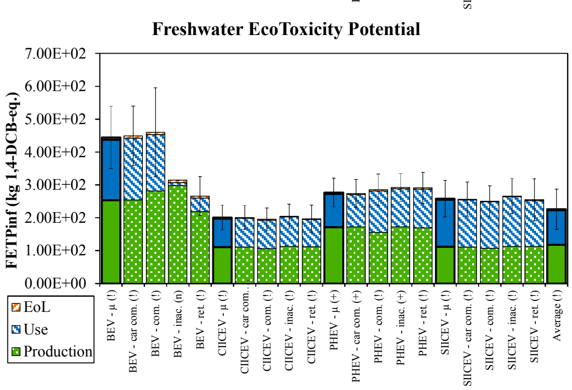

Freshwater Eutrophication Potential
FEP (kg P-eq.)
EoL
Use
Production

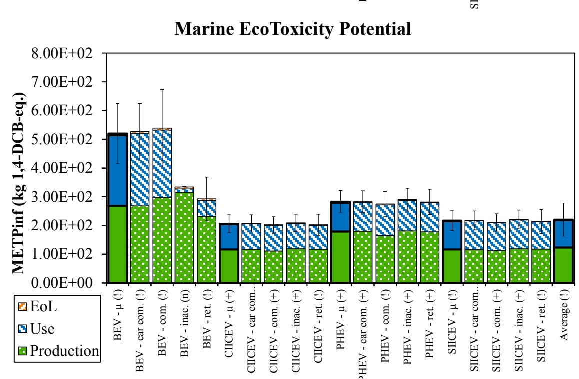

Global Warming Potential
GWP100 (kg CO2-eq.)
EoL
Use
Production

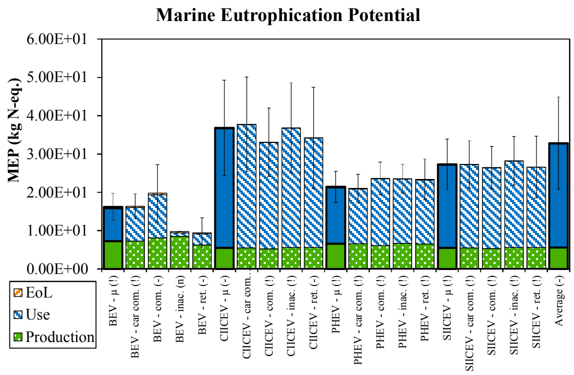

Human Toxicity Potential
HTTP (kg 1,4 DCB-eq.)
EoL
Use
Production

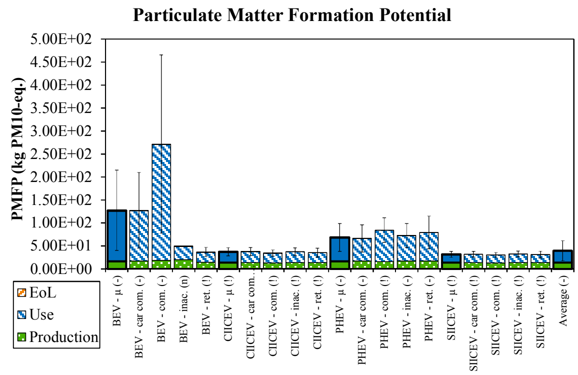

Fossil ressource Depletion Potential
FDP (kf Oil-eq.)
EoL
Use
Production

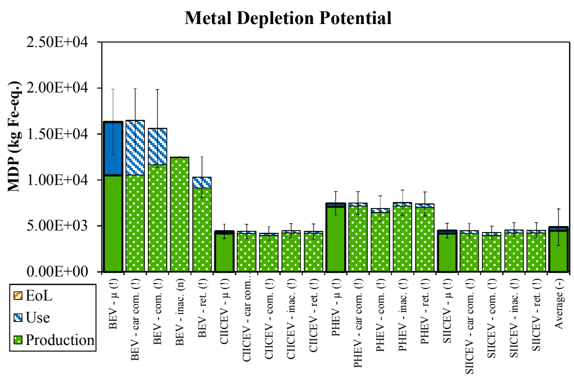

Ionising Radtion Potential
IRP_HE (kg U235-eq.)
EoL
Use
Production

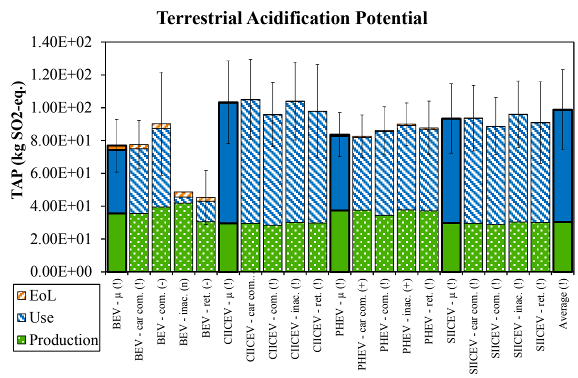

Freshwater EcoToxicity Potential
FETPinf (kg 1,4-DCB-eq.)
EoL
Use
Production

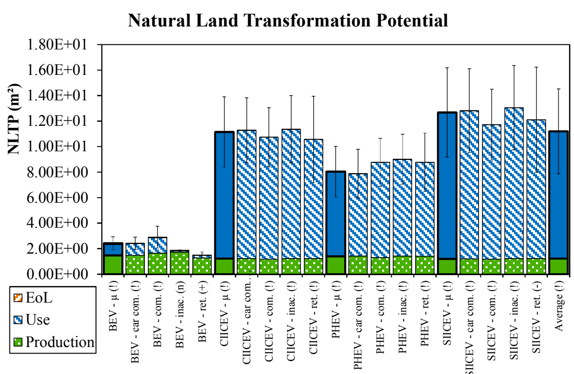

Marine EcoToxicity Potential
METPinf (kg 1,4-DCB-eq.)
EoL
Use
Production

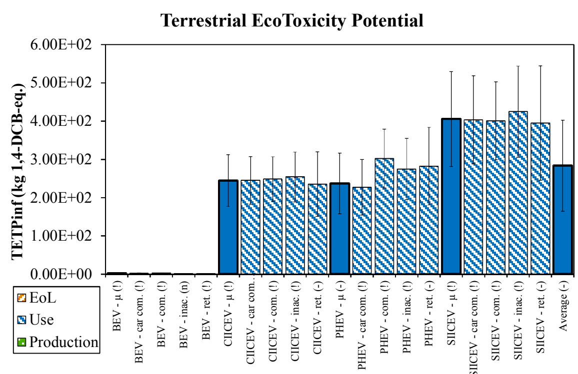

Marine Eutrophication Potential
MEP (kg N-eq.)
EoL
Use
Production

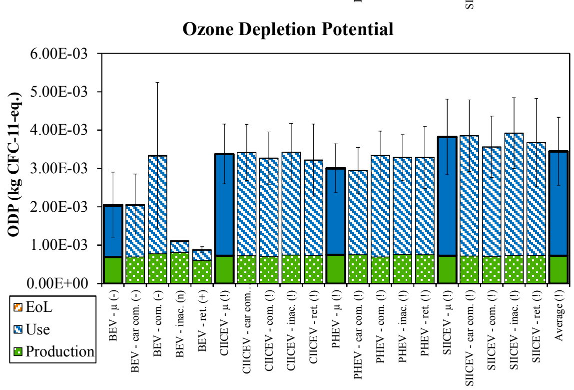

Particulate Matter Formation Potential
PMFP (kg PM10-eq.)
EoL
Use
Production

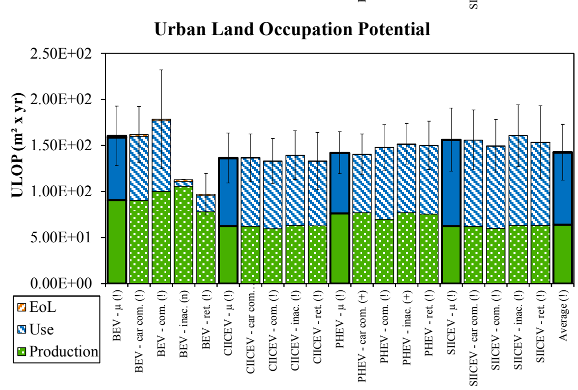

Metal Depletion Potential
MDP (kg Fe-eq.)
EoL
Use
Production

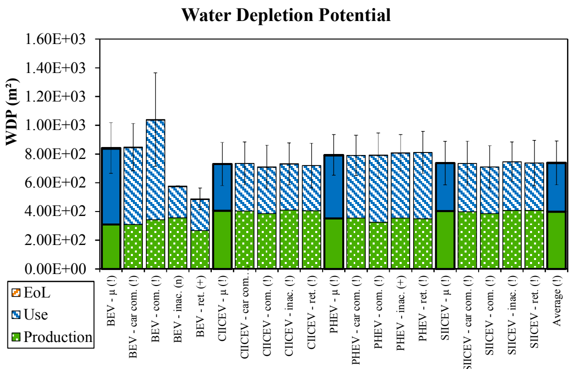

Terrestrial Acidification Potential
TAP (kg SO2-eq.)
EoL
Use
Production


Natural Land Transformation Potential
NLTP (m²)
EoL
Use
Production


Terrestrial EcoToxicity Potential
TETPinf (kg 1,4-DCB-eq.)
EoL
Use
Production

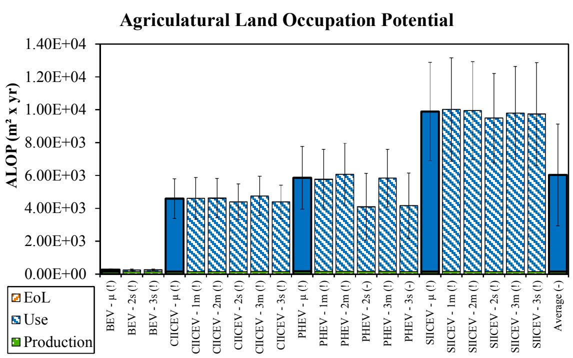

Ozone Depletion Potential
ODP (kg CFC-11-eq.)
EoL
Use
Production

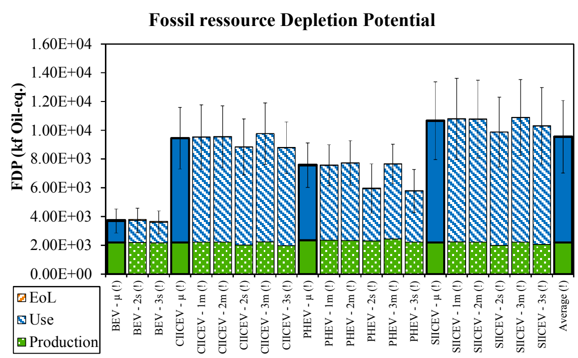

Urban Land Occupation Potential
ULOP (m² x yr)
EoL
Use
Production

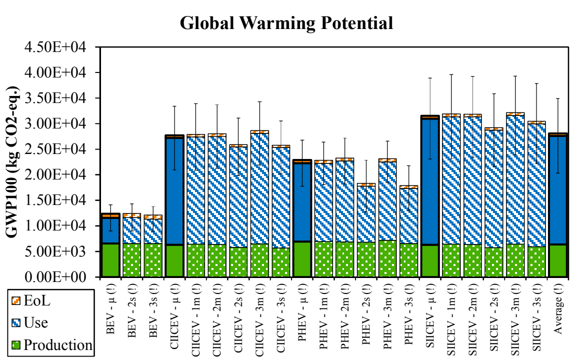


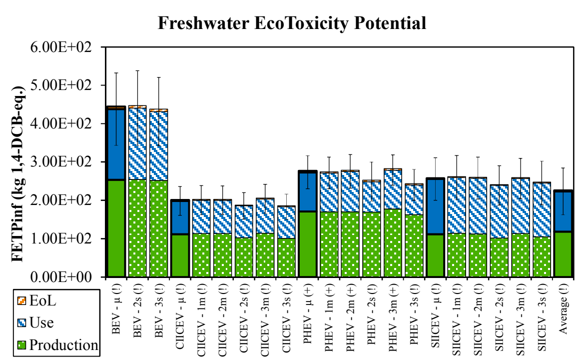
S5.9 Impacts per vehicle, per 1st owner household

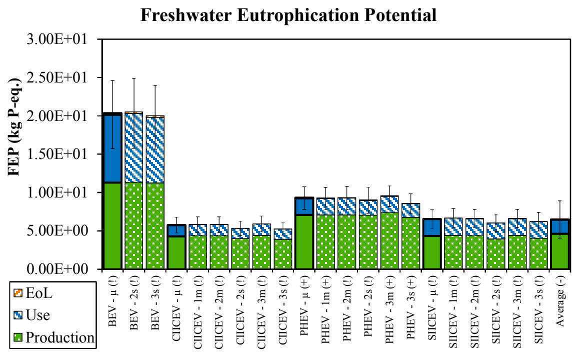
Glossary: ***1m:*** *single individual;* ***2m:*** *main car of couple household;* ***2s:*** *second car of couple household;* ***3m:*** *main car of 3-person household;* ***3s:*** *second or third car of 3-person household;* ***BEV:*** *battery-powered electric vehicle;* ***CIICEV:*** *compression-ignition (diesel) internal combustion engine vehicle;* ***NEDC:*** *new European driving cycle;* ***PHEV:*** *plug-in hybrid electric vehicle;* ***SIICEV:*** *spark-ignition (gasoline) internal combustion engine vehicle;* ***μ:*** *average;*

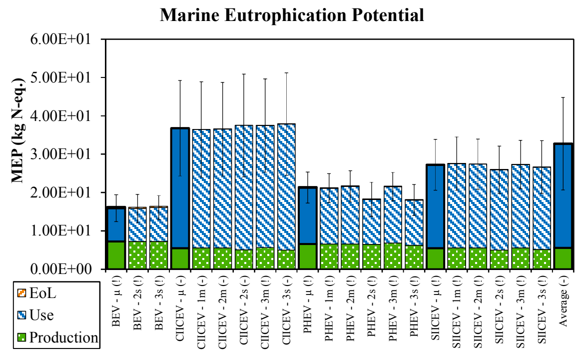


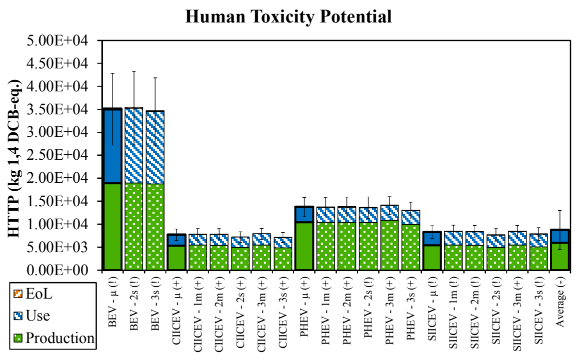


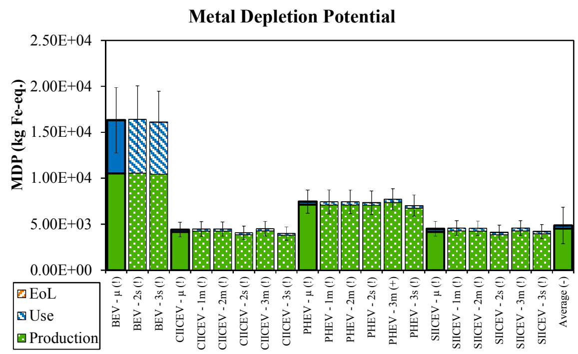


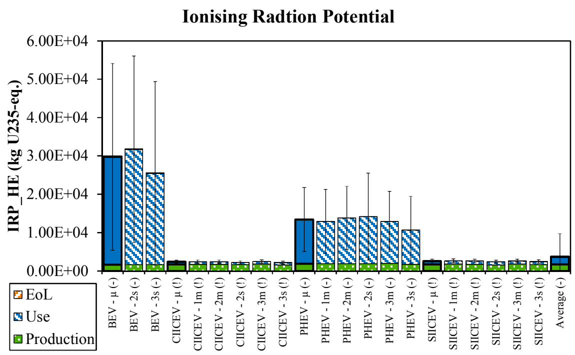


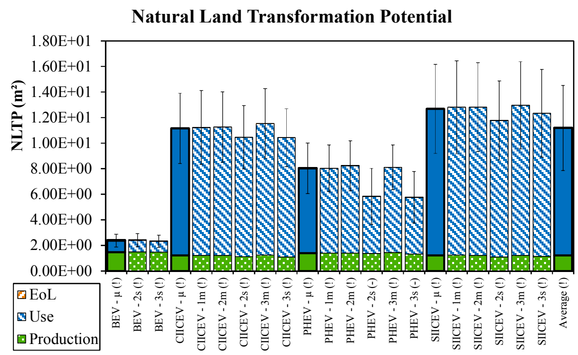

Freshwater Eutrophication Potential
FEP (kg P-eq.)
EoL
Use
Production

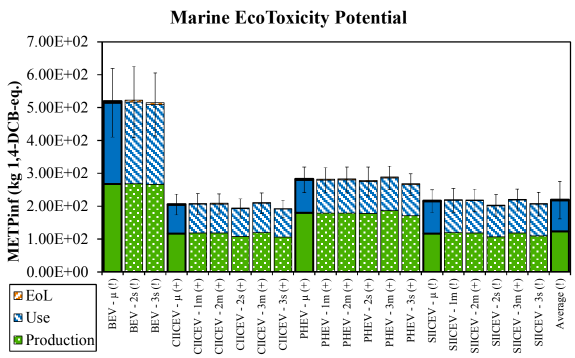

Marine Eutrophication Potential
MEP (kg N-eq.)
EoL
Use
Production

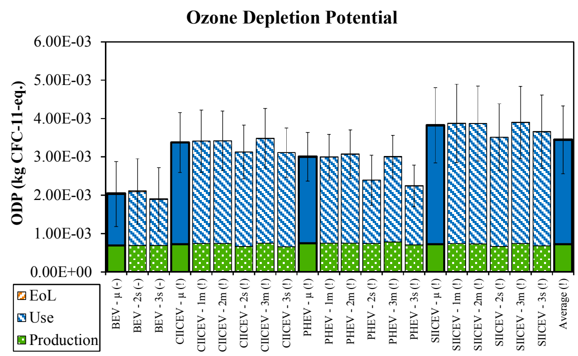

Human Toxicity Potential
HTTP (kg 1,4 DCB-eq.)
EoL
Use
Production

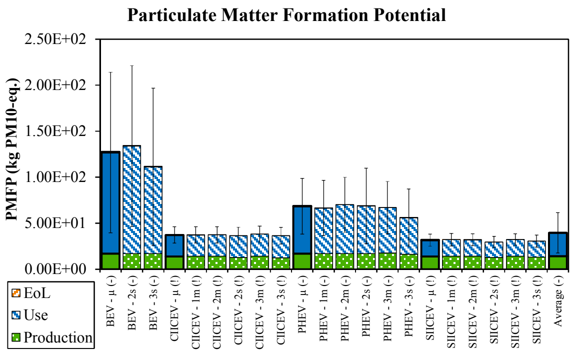

Metal Depletion Potential
MDP (kg Fe-eq.)
EoL
Use
Production

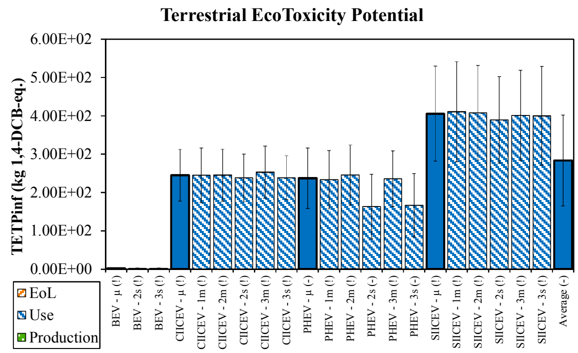

Ionising Radtion Potential
IRP_HE (kg U235-eq.)
EoL
Use
Production

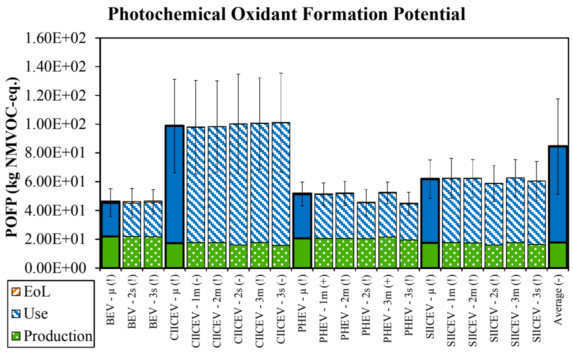

Natural Land Transformation Potential
NLTP (m²)
EoL
Use
Production

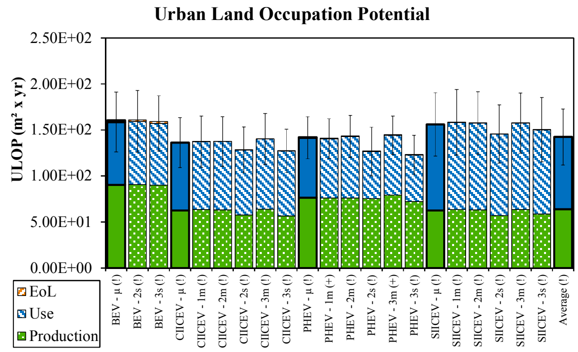

Marine EcoToxicity Potential
METPinf (kg 1,4-DCB-eq.)
EoL
Use
Production

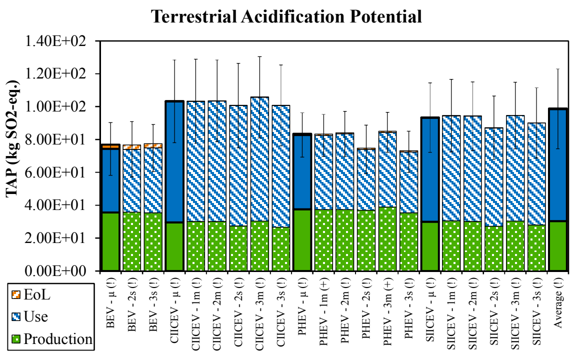

Ozone Depletion Potential
ODP (kg CFC-11-eq.)
EoL
Use
Production

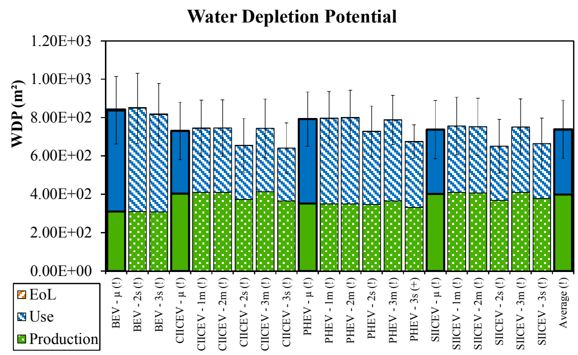






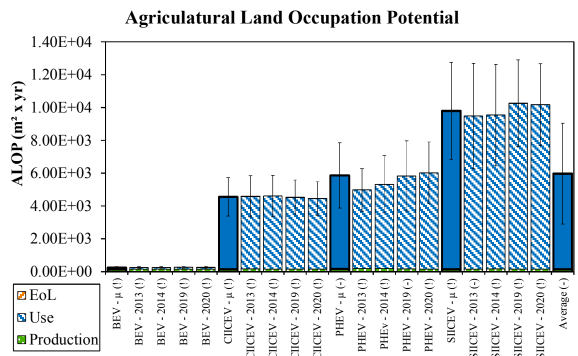


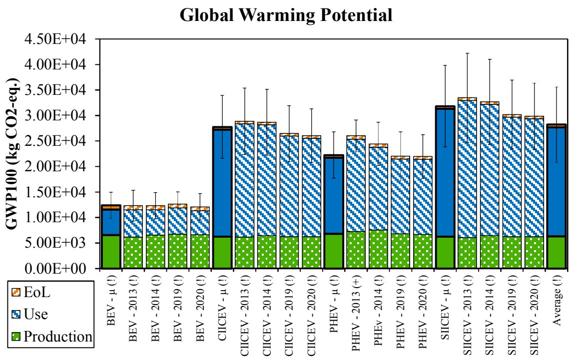


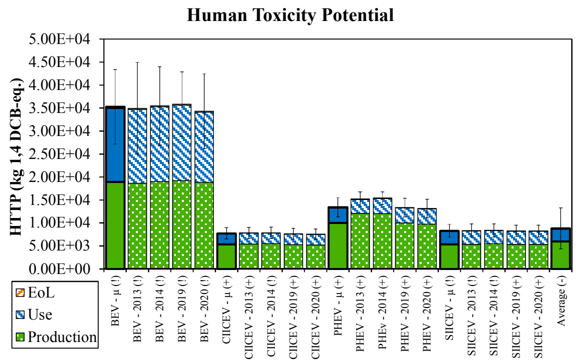


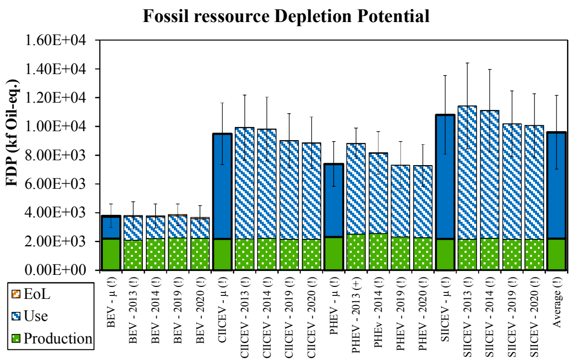
S5.10 Impacts per vehicle, per purchase year

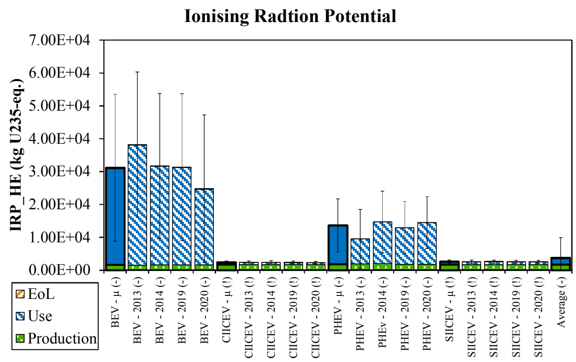
Glossary: ***BEV:*** *battery-powered electric vehicle;* ***CIICEV:*** *compression-ignition (diesel) internal combustion engine vehicle;* ***NEDC:*** *new European driving cycle;* ***PHEV:*** *plug-in hybrid electric vehicle;* ***SIICEV:*** *spark-ignition (gasoline) internal combustion engine vehicle;* ***μ:*** *average;*

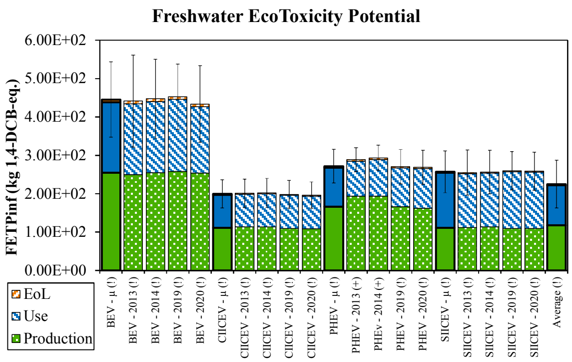


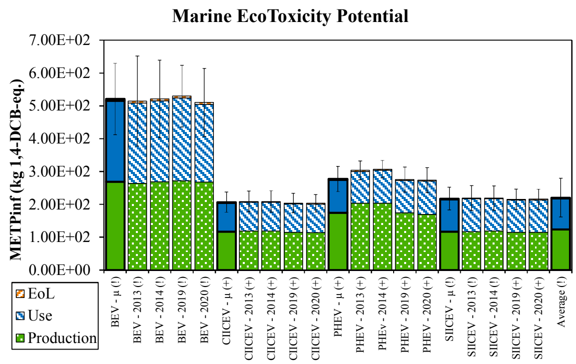

Global Warming Potential
GWP100 (kg CO2-eq.)
EoL
Use
Production

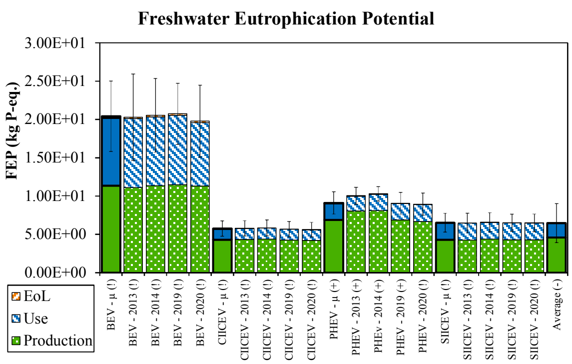

Human Toxicity Potential
HTTP (kg 1,4 DCB-eq.)
EoL
Use
Production

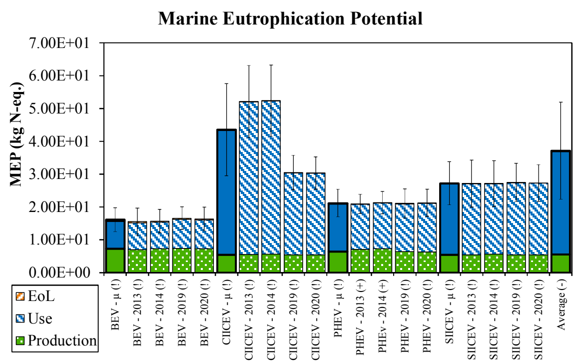

Fossil ressource Depletion Potential
FDP (kf Oil-eq.)
EoL
Use
Production

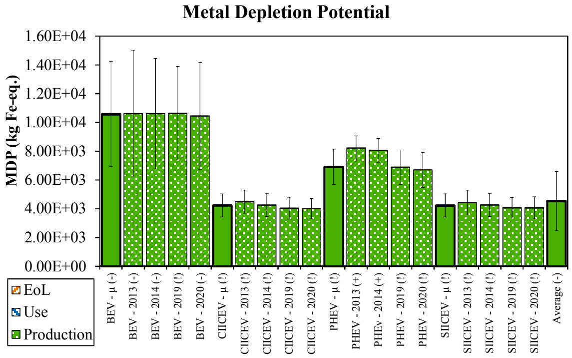

Ionising Radtion Potential
IRP_HE (kg U235-eq.)
EoL
Use
Production

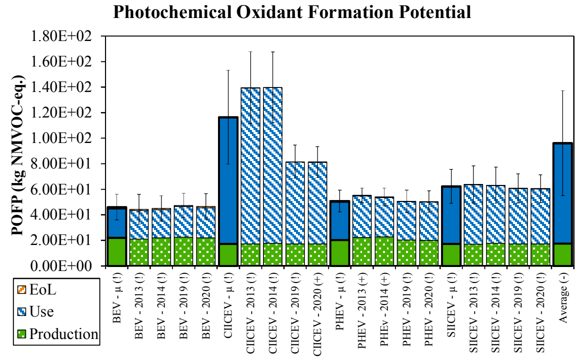

Freshwater EcoToxicity Potential
FETPinf (kg 1,4-DCB-eq.)
EoL
Use
Production

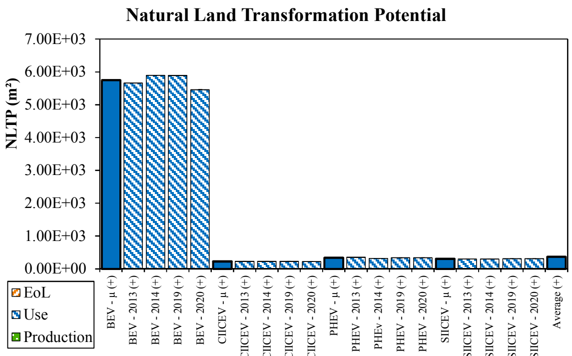

Marine EcoToxicity Potential
METPinf (kg 1,4-DCB-eq.)
EoL
Use
Production

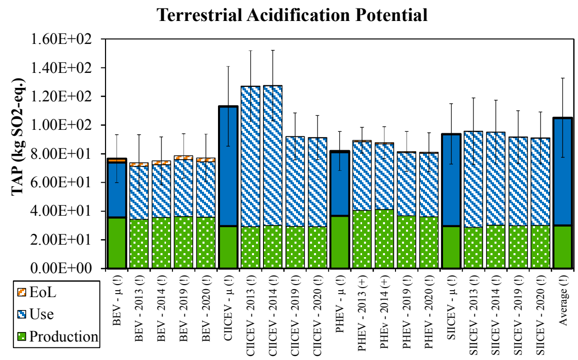

Freshwater Eutrophication Potential
FEP (kg P-eq.)
EoL
Use
Production

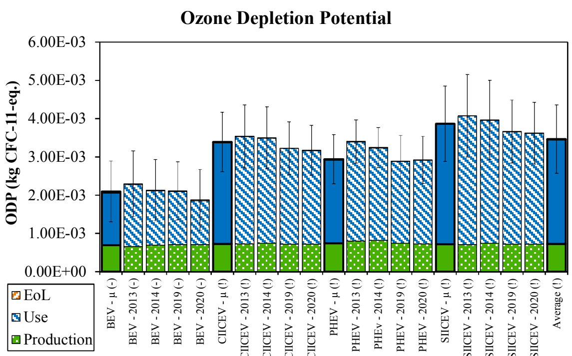

Marine Eutrophication Potential
MEP (kg N-eq.)
EoL
Use
Production

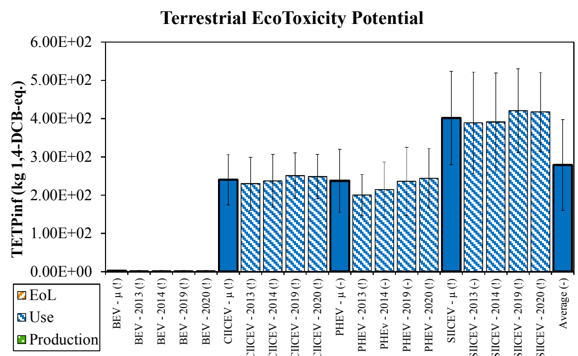

Metal Depletion Potential
MDP (kg Fe-eq.)
1.60E+04
1.40E+04
1.20E+04
1.00E+04
8.00E+03
6.00E+03
4.00E+03
2.00E+03
0.00E+00
EoL
Use
Production

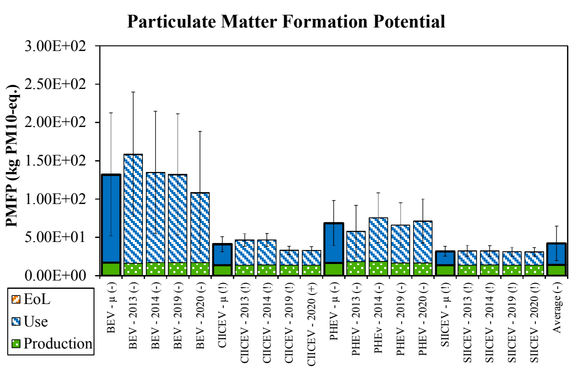

Photochemical Oxidant Formation Potential
POFP (kg NMVOC-eq.)
1.80E+02
1.60E+02
1.40E+02
1.20E+02
1.00E+02
8.00E+01
6.00E+01
4.00E+01
2.00E+01
0.00E+00
EoL
Use
Production

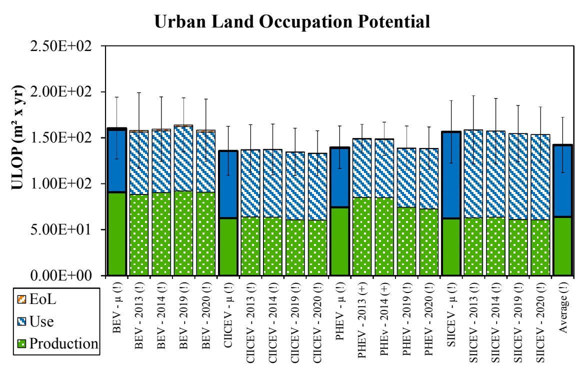

Natural Land Transformation Potential
NLTP (m²)
7.00E+03
6.00E+03
5.00E+03
4.00E+03
3.00E+03
2.00E+03
1.00E+03
0.00E+00
EoL
Use
Production


Terrestrial Acidification Potential
TAP (kg SO2-eq.)
1.60E+02
1.40E+02
1.20E+02
1.00E+02
8.00E+01
6.00E+01
4.00E+01
2.00E+01
0.00E+00
EoL
Use
Production


Ozone Depletion Potential
ODP (kg CFC-11-eq.)
6.00E-03
5.00E-03
4.00E-03
3.00E-03
2.00E-03
1.00E-03
0.00E+00
EoL
Use
Production


Terrestrial EcoToxicity Potential
TETPinf (kg 1,4-DCB-eq.)
6.00E+02
5.00E+02
4.00E+02
3.00E+02
2.00E+02
1.00E+02
0.00E+00
EoL
Use
Production


Particulate Matter Formation Potential
PMFP (kg PM10-eq.)
3.00E+02
2.50E+02
2.00E+02
1.50E+02
1.00E+02
5.00E+01
0.00E+00
EoL
Use
Production


Urban Land Occupation Potential
ULOP (m² x yr)
2.50E+02
2.00E+02
1.50E+02
1.00E+02
5.00E+01
0.00E+00
EoL
Use
Production

S5.11 Additional impacts for scenario results (3.1)

Glossary: ***ALOP:*** *agricultural land occupation;* ***GWP100:*** *global warming;* ***FDP:*** *fossil depletion;* ***FETPinf:*** *freshwater ecotoxicity;* ***FEP:*** *freshwater eutrophication;* ***HTPinf:*** *human toxicity;* ***IRP:*** *ionising radiations;* ***METPinf:*** *marine tcotoxicity;* ***MEP:*** *marine eutrophication;* ***MDP:*** *metal depletion;* ***NLTP:*** *natural land transformation;* ***ODPinf:*** *ozone depletion;* ***PMFP:*** *particulate matter formation;* ***POFP:*** *photochemical ozone formation;* ***Q€:*** *scenario with incentives and charging infrastructure deployment;* ***TAP100:*** *terrestrial acidification;* ***TETPinf:*** *terrestrial ecotoxicity;* ***ULOP:*** *Urban land occupation;* ***WDP:*** *water depletion;*

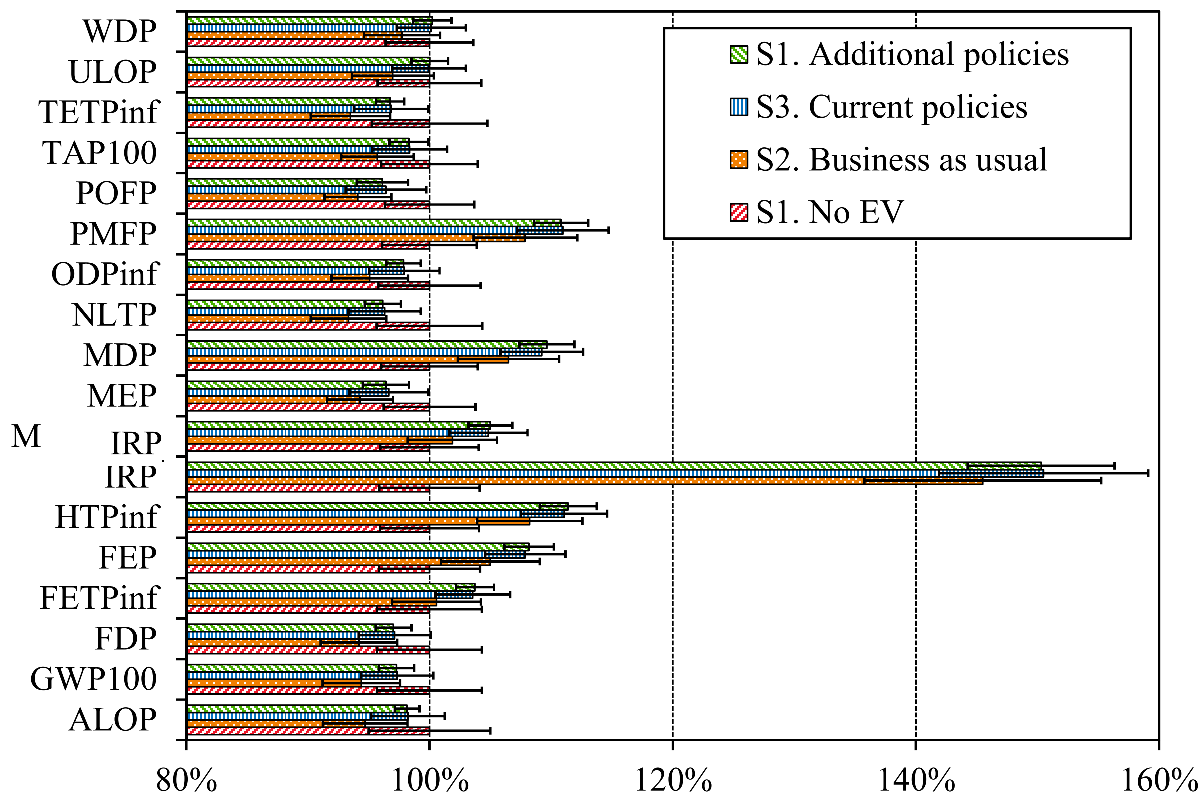


Figure S5.11.1: Complete results for scenario analysis (details and explanation are provided in section 3.1 of main article).

S5.12 Sensitivity analysis – battery lifetime

Glossary: ***GWP100:*** *global warming;* ***FDP:*** *fossil depletion;* ***FEP:*** *freshwater eutrophication;* ***HTPinf:*** *human toxicity;* ***IRP:*** *ionising radiations;* ***MEP:*** *marine eutrophication;* ***MDP:*** *metal depletion;* ***PMFP:*** *particulate matter formation;* ***POFP:*** *photochemical ozone formation;* ***TAP100:*** *terrestrial acidification;*

In the article, the lifetime of the battery is equal to 80,000km. The graph below is the same as the figure 3 in the main article, except that in this case the lifetime of the battery is equal to the lifetime of EVs.

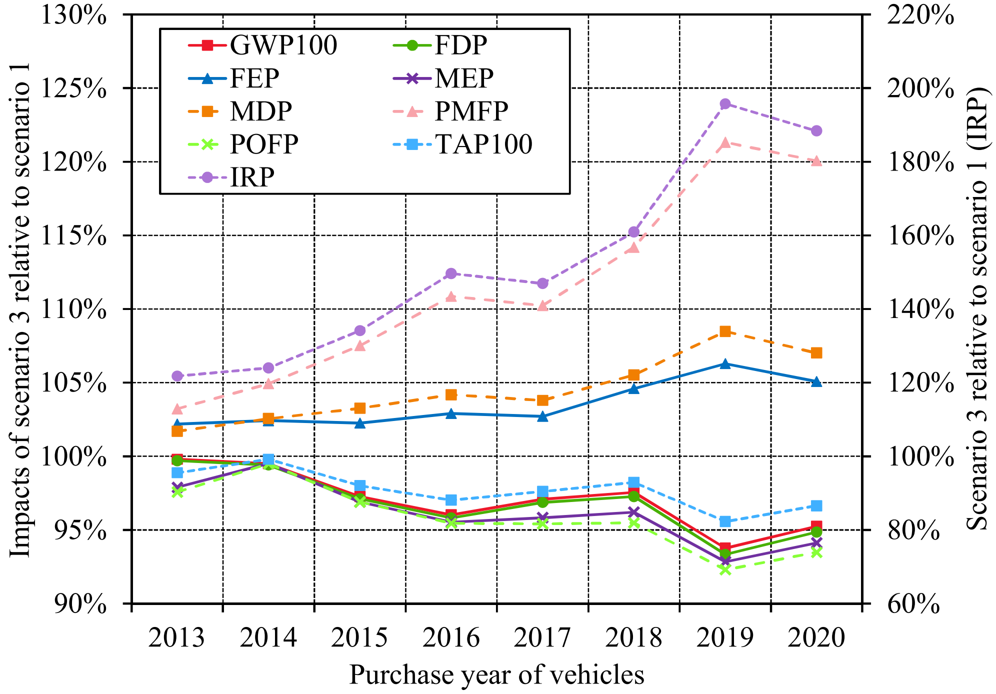


Figure S5.12.1: LCA results of scenario 3 (current policies) relative to Scenario 1 (no EV). Relative values are shown according to vehicle purchase year. In this case, the battery lasts during the full lifetime of battery-EVs and plug-in hybrid EVs

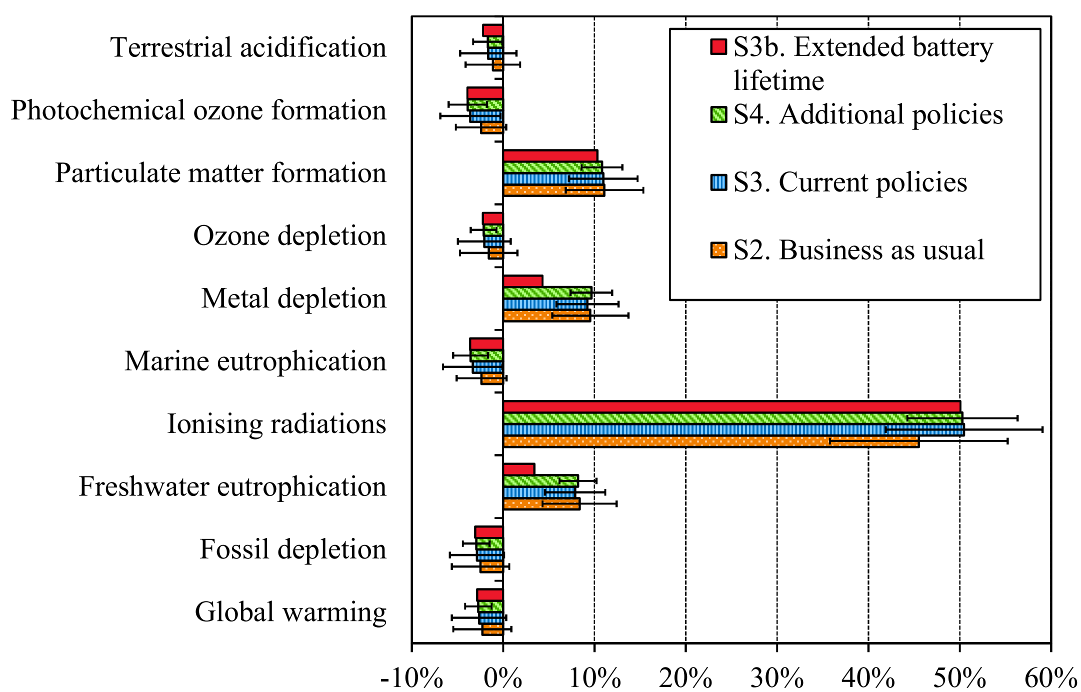


Figure S5.12.2: LCA results of the 3 EV deployment scenarios, relative to the scenario without EV. For sensitivity analysis, a 5th scenario has been added. This scenario corresponds to scenario 3, with a battery having the same lifetime as EVs.

S5.13 Scenario results – absolute values (3.1)

Glossary: ***ALOP:*** *agricultural land occupation;* ***GWP100:*** *global warming;* ***FDP:*** *fossil depletion;* ***FETPinf:*** *freshwater ecotoxicity;* ***FEP:*** *freshwater eutrophication;* ***HTPinf:*** *human toxicity;* ***IRP:*** *ionising radiations;* ***METPinf:*** *marine tcotoxicity;* ***MEP:*** *marine eutrophication;* ***MDP:*** *metal depletion;* ***NLTP:*** *natural land transformation;* ***ODPinf:*** *ozone depletion;* ***PMFP:*** *particulate matter formation;* ***POFP:*** *photochemical ozone formation;* ***Q€:*** *scenario with incentives and charging infrastructure deployment;* ***TAP100:*** *terrestrial acidification;* ***TETPinf:*** *terrestrial ecotoxicity;* ***ULOP:*** *Urban land occupation;* ***WDP:*** *water depletion;*

Impacts	S2. Business as usual	S3. Current policies	4. Additional incentives
ALOP (m^2.yr)	-2.21E+08 ± 1.45E+08	-7.36E+07 ± 1.27E+08	-7.65E+07 ± 4.22E+07
GWP_{100} (kg $CO_{2\text{-eq.}}$)	-1.10E+09 ± 6.24 E+08	-5.19E+08 ± 5.82 E+08	-5.33E+08 ± 2.85 E+08
FDP (kg $oil_{\text{-eq.}}$)	-3.88E+08 ± 2.11 E+08	-1.91E+08 ± 1.98 E+08	-1.98E+08 ± 9.77 E+07
$FETP_{inf}$ (kg 1,4-$DCB_{\text{-eq.}}$)	8.47E+05 ± 5.42 E+06	5.29E+06 ± 4.53 E+06	5.55E+06 ± 2.31 E+06
FEP (kg $P_{\text{-eq.}}$)	2.05E+05 ± 1.65 E+05	3.22E+05 ± 1.35 E+05	3.35E+05 ± 8.29 E+04
HTP_{inf} (kg 1,4-$DCB_{\text{-eq.}}$)	4.44E+08 ± 2.33 E+08	5.97E+08 ± 1.90 E+08	6.16E+08 ± 1.26 E+08
IRP (kg $U^{235}{}_{\text{-eq.}}$)	7.62E+08 ± 1.63 E+08	8.45E+08 ± 1.44 E+08	8.42E+08 ± 1.01 E+08
$METP_{inf}$ (kg 1,4-$DCB_{\text{-eq.}}$)	2.70E+06 ± 5.24 E+06	6.93E+06 ± 4.59 E+06	7.16E+06 ± 2.58 E+06
MEP (kg $N_{\text{-eq.}}$)	-1.32E+06 ± 6.30 E+05	-7.68E+05 ± 7.49 E+05	-8.25E+05 ± 4.39 E+05
MDP (kg $Fe_{\text{-eq.}}$)	1.96E+08 ± 1.26 E+08	2.79E+08 ± 1.03 E+08	2.92E+08 ± 6.86 E+07
NLTP (m^2)	-5.26E+05 ± 2.45 E+05	-2.92E+05 ± 2.35 E+05	-3.04E+05 ± 1.17 E+05
ODP_{inf} (kg $CFC11_{\text{-eq.}}$)	-1.18E+02 ± 7.53 E+01	-4.94E+01 ± 6.92 E+01	-5.13E+01 ± 3.39 E+01
PMFP (kg $PM10_{\text{-eq.}}$)	1.91E+06 ± 1.03 E+06	2.66E+06 ± 9.10 E+05	2.62E+06 ± 5.40 E+05
POFP (kg $NMVOC_{\text{-eq.}}$)	-3.51E+06 ± 1.64 E+06	-2.14E+06 ± 1.97 E+06	-2.31E+06 ± 1.26 E+06
TAP_{100} (kg $SO_{2\text{-eq.}}$)	-2.93E+06 ± 2.04 E+06	-1.11E+06 ± 2.10 E+06	-1.15E+06 ± 1.09 E+06
$TETP_{inf}$ (kg 1,4-$DCB_{\text{-eq.}}$)	-1.29E+07 ± 6.51 E+06	-6.28E+06 ± 6.10 E+06	-6.42E+06 ± 2.29 E+06
ULOP (m^2.yr)	-2.92E+06 ± 3.26 E+06	-4.25E+04 ± 2.93 E+06	2.80E+04 ± 1.47 E+06
WDP (m^3)	-1.13E+07 ± 1.57 E+07	7.30E+05 ± 1.42 E+07	1.20E+06 ± 7.87 E+06

Figure S5.13.1: Results of scenarios S2, S3 and S4 compared to S1. "no EV".

S6. State of the art of LCA of road vehicles

Because of their absence of tailpipe emissions, the variability of the electricity sources they can use and the uncertainties associated with the management and use of batteries, EVs are widely studied in the literature. Hawkins et al. (2012) compared 51 studies and concluded that, despite the variety of lifetimes and consumptions considered, full Battery-powered EVs (BEVs) tend to have lower environmental impacts than ICEVs, except when they use coal electricity. They also showed that most studies focus on global warming potential (GWP), although they should include the issues associated with other potential impacts (for instance SO2 emissions linked with coal electricity).

Barat et al. (2011) compared a Renault Fluence ZE BEV model with its ICE counterparts. Using CML 2001 methodology (Guinée, 2002), they showed that, on the car whole life cycle, the results were different considering the French or the English electricity mix. When charged in France, the BEV has lower impacts than ICEVs. However, when used in the UK, eutrophication potential is higher and acidification potential is close to the Compression-Ignition ICEV (CIICEV). Hawkins et al. (2013) compared a Nissan LEAF with a Mercedes A-Class, using ReCiPe2008 methodology (Goedkoop et al. 2009) in a European context. They showed that the BEV can decrease GWP, as well as fossil energy use and photochemical oxidant formation, while acidification is close to ICEV and metal depletion and toxicity/ecotoxicity increase (although the author emphasize that these results are more uncertain). Querini et al. (2012) calculated the GHG emissions associated with EVs using wind and photovoltaic electricity. They compared a Renault Fluence ZE with an ICEV representative of the sold fleet in 2011 and a "champion" car with 90 g CO2 / km tailpipe emissions. They showed that the BEV always emits less GHG, on its whole life cycle, compared to ICEVs. Other relevant studies (Samaras and Meisterling (2008), Campanari et al. (2009), Faria et al. (2012) and Ma et al. (2012)) focused on GHG emissions or energy demand and concluded to the benefit of EVs.

Other studies focused on the battery, as all the aforementioned sources pointed it out as the main potentially impacting part of EVs. However, Matheys et al. (2007) showed that the results of different studies could lead to various results because of the strong influence of the functional unit. Indeed, Zackrisson et al. (2010) pointed out that the use phase of the battery is strongly dependent on the electricity mix used (they distinguished between Scandinavia and China) and calculated that the main potential impacts of battery production are ozone depletion, eutrophication and photochemical oxidant formation. Notter et al. (2010) published a detailed inventory of a lithium manganese oxide battery and assessed the contribution of this battery to an EV whole life cycle. Contrary to other studies, they calculated that the battery only accounted for a small part of EVs' impacts (between 10% to one third). They also stressed the importance of the operation phase compared with battery production. Majeau-Bettez et al. (2011) have calculated the potential impacts associated with the production of three types of battery (Nickel-metal hybride, lithium –ion nickel cobalt manganese oxide and lithium-ion iron phosphate). They showed that that Li-Ion Iron phosphate battery has the smallest potential impacts and that, depending on the impacts, positive electrode paste, electrode substrate and battery management systems were the most significant parts. Like the other studies, they pointed out the crucial role of the functional unit.

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