Supplementary Information

Table S1. EV Consumption data used in the study and their respective sources

	Model	Fuel [l/100 km]	Energy [kWh/100km]	Vehicle Emissions [kg CO2/km]	Range [km]	Registrations in 2018 [1]
Compact-size						
BEV	Hyundai Ioniq [2]		11.5		280	1695
	Average value used		**11.5**		**280**	
PHEV	Audi A3, S3, RS3 [3]	1.8 – 1.6	12.0 – 11.4	0.040 – 0.036	50	1682
	Average value used	**1.7**	**11.7**	**0.038**	**50**	
SUV						
BEV	Mercedes-Benz EQC [4]	-	20.8 – 19.7	-	445 – 471	-
	Tesla Model X [5]	-	22.6 – 20.8	-		-
	Average value used		**20.9**		**458**	
PHEV	Mercedes-Benz GLC [6]	2.7 – 2.5	15.2 – 13.9	0.064 – 0.059	34	1459
	Kia Niro [7]	1.3	10.5 [8]	0.029	58	1440
	Mitsubishi Outlander [9]	1.8	14.8	0.03	54	2193
	Average value used	**1.9**	**13.5**	**0.043**	**49.4**	
FCEV	Hyundai Nexo [10]	0.84*			756	
	Average value used	0.84*			756	
FC PHEV	Mercedes-Benz GLC Fuel Cell [11]	0.34*	13.7		437+49 [12]	
	Average value used	0.34*	13.7		486	
Mid-size						
BEV	Tesla Model S [5]	-	20.0 – 18.1		413 [13]	
	Average value used		19.1		413	

PHEV	Mercedes-Benz E-Class [14]	1.5	-	0.041		1636
	Volvo 90 [15]	1.9	15.9 [16]	0.043	52 [17]	282
	BMW 5er [18]	2.1 – 1.9	14.1 – 13.1	0.049 – 0.044		1888
	Average value used	1.8	13.9	0.044	52	
FCEV	Toyota Mirai [19]	0.76*	-		500	
	Honda Clarity [20]	0.77*	-		589	
	Average value used	0.77*			544.5	

*in kg H_2/100 km

Table S2. Estimation of CO_2 emissions of fuel supply for ICV

The average fuel supply in kg CO_2/l was calculated by collecting LCA data from available studies. An average value from all available data was calculated and used in further calculations.

	Fuel Supply [kg CO_2/vehicle]	**Lifecycle Distance [km/vehicle]**	**Fuel Supply [kg CO_2/km]**	**Fuel Consumption [l/100km]** [1]	**Calculated Fuel Supply [kg CO_2/l]**
Petrol					
Mercedes-Benz A-Class [21]	3600	160,000	0.0225		
ADAC [22]	3600	150,000	0.0240		
Volkswagen Golf [23]			0.0243		
Average			0.0236	5.4	**0.437**
Diesel					
Mercedes-Benz A-Class [21]	1600		0.0100		
ADAC [22]	3650		0.0243		
Volkswagen Golf [23]	-	-	0.0099		
Average				4.2	**0.3511**
Petrol					
Mercedes-Benz E-Class	6100	250,000	0.0244		
ADAC [22]	5800	150,000	0.0387		
Average			0.0315	7.3	**0.4320**
Diesel					
Mercedes-Benz E-Class [24]	2.100	250,000	0.0084		
ADAC [22]	4.400	150,000	0.0293		
Average			0.0189	5.1	**0.3699**
Petrol					
Mercedes-Benz S-Class	11.200	300,000	0.0373		
Average			0.0373	9.2	**0.4058**
				Average Petrol	0.4249
				Average Diesel	0.3605
				Average Petrol & Diesel	0.3927

Table S3. LCA data for CO_2 emission calculation

Segment	Production [kg CO_2]	End of Life [kg CO_2]	Fuel Supply [kg CO_2/l]	Electricity Supply [kg CO_2/kWh]	Fuel Consumption [l/100km]	Electricity Consumption [kWh/ 100km]	Emissions [kg CO_2/ km]
Today							
Compact-size (120,000 km)							
Otto	5700 [21]	300 [21]	0.4249 (Table S.2)	-	5.4 [1]	-	5.4 [1]
Diesel	6100 [21]	300 [21]	0.3605 (Table S.2)	-	4.2 [1]	-	5.4 [1]
BEV	10,260 [23]	300 *	-	0.2250 [25]	-	11.5 (Table S.1)	-
PHEV	7900 [26]		0.4249 (Table S.2)	0.2250 [25]	1.7 (Table S.1)	11.7 (Table S.1)	0.038 (Table S.1)
SUV (160,000 km)							
Otto	8500*	500 *	0.4249 (Table S.2)		6.0 [1]	-	0.1382 [1]
Diesel	9100 [27]	500 [27]	0.3605 (Table S.2)		5.0 [1]	-	0.1314 [1]
BEV	17,000*	500 *	-	0.2250 [25]	-	20.9 (Table S.1)	-
PHEV	11,100 [27]	500 [27]	0.4249 (Table S.2)	0.2250 [25]	1.89 (Table S.1)º	13.5 (Table S.1)	0.0432 (Table S.1)
FCEV	11,486*	500 *	10.866 [28]	-	-	0.84** (Table S.1)	-
FC PHEV	15,000 [27]	200 *	10.8666 [28]	0.2250 [25]	0.34 (Table S.1)	13.7 (Table S.1)	-
Mid-size (250,000 km)							
Otto	7800 [24]	400 [24]	0.4249 (Table S.1)	-	7.3 [1]	-	0.1688 [1]
Diesel	8300 [24]	400 [24]	0.3605 (Table S.1)	-	5.1 [1]	-	0.1357 [1]
BEV	19,800 [26]	400 *	-	0.2250 [25]	-	19.1 (Table S.1)	-
PHEV	10,000	400 [24]	0.3927 (Table S.1)	0.2250 [25]	1.81 (Table S.1)	13.9 (Table S.1)	0.0440 (Table S.1)
FCEV	10,541*	400 *	10.866 [28]	-	-	0.77** (Table S.1)	-
2030							
Compact-size (120,000 km)							

Otto	5700 [21]	300 [21]	0.3144 ***	-	4.17***	-	-
Diesel	6100 [21]	300 [21]	0.2956 ***	-	3.72***	-	-
BEV	10,260 [23]	300 *	-	0.0920 [25]	-	10.19***	280 (Table S.1)
PHEV	7900 [26]		0.3144 ***	-	1.51***	10.37***	50 (Table S.1)
SUV (160,000 km)							
Otto	8500*	500 *	0.3144 ***	-	5.31***	-	-
Diesel	9100 [27]	500 [27]	0.2956 ***	-	4.43***	-	-
BEV	17,000*	500 *	-	0.0920 [25]	-	18.59***	458 (Table S.1)
PHEV	11,100 [27]	500 [27]	0.3144 ***	0.0920 [25]	1.67***	11.98***	50 (Table S.1)
FCEV	11,486*	500 *	9.9774 [28]	-	0.74***	-	-
FC PHEV	15,000 [27]	500 *	9.9774 [28]	0.0920 [25]	0.30***	12.14***	49 (Table S.1)
Mid-size (250,000 km)							
Otto	7800 [24]	400 [24]	0.3144 ***	-	5.31***	--	-
Diesel	8300 [24]	400 [24]	0.2956 ***	-	4.43***	-	-
BEV	19,800 [26]	400 *	-	0.0920 [25]	-	18.59***	413 (Table S.1)
PHEV	10,000	400 [24]	0.3050 ***	0.0920 [25]	1,67***	11.98***	52 (Table S.1)
FCEV	10,541*	400 *	9.9774 [28]	-	0.67***	-	-

*assumed the same as other vehicle types as explained in manuscript

** in kg H_2

***derived from today's LCA data as explained in manuscript

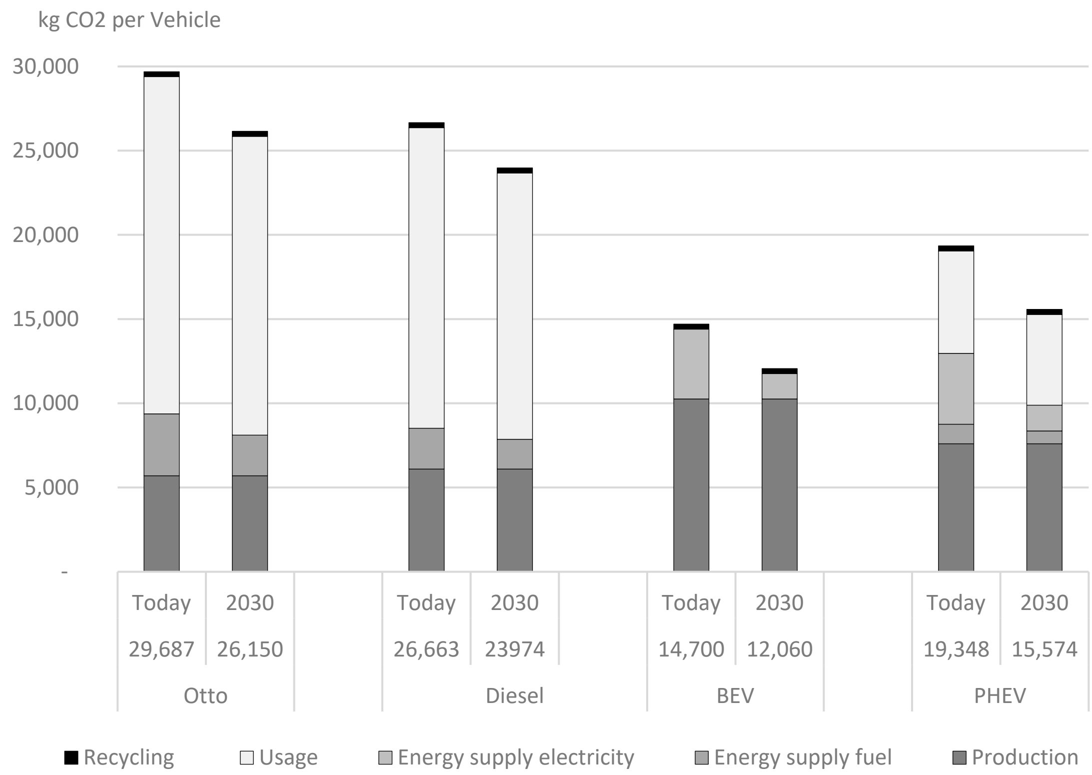

Figure S1 LCA comparison for CO2 emissions: compact segments

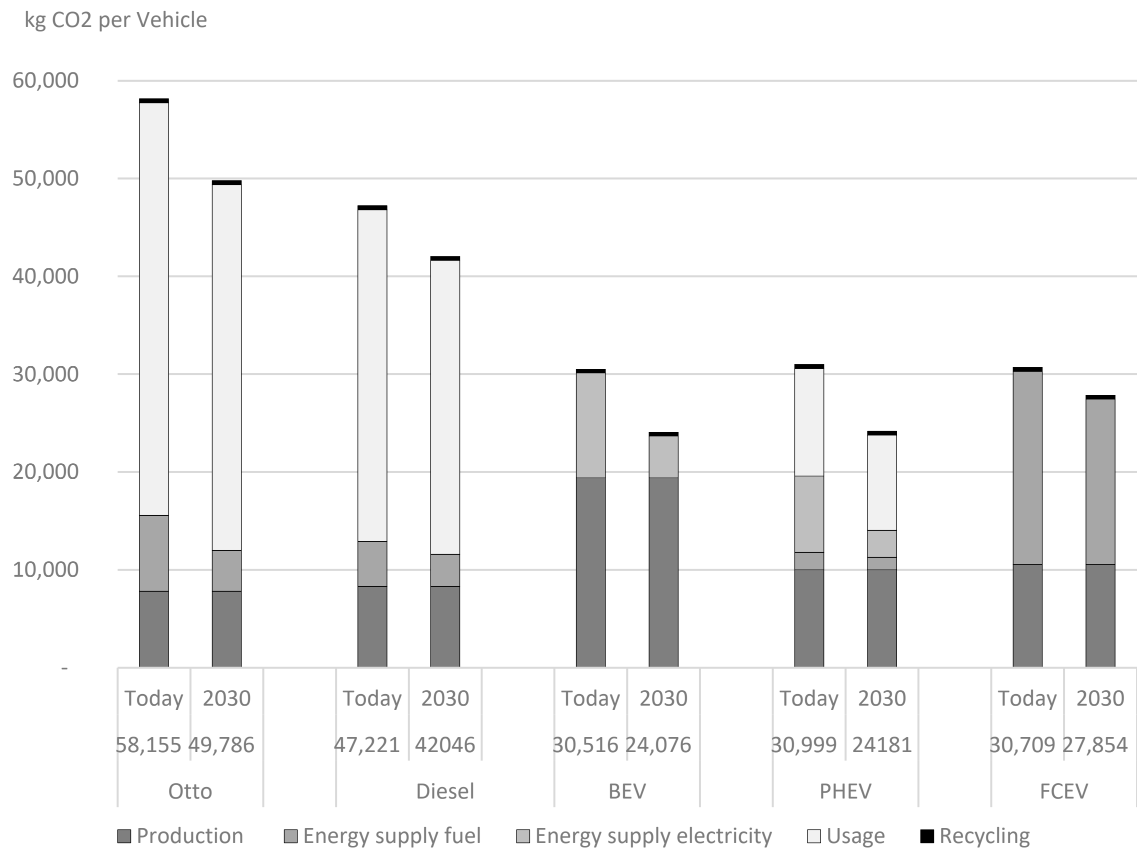

Figure S2 LCA comparison for CO2 emissions: mid-size segments

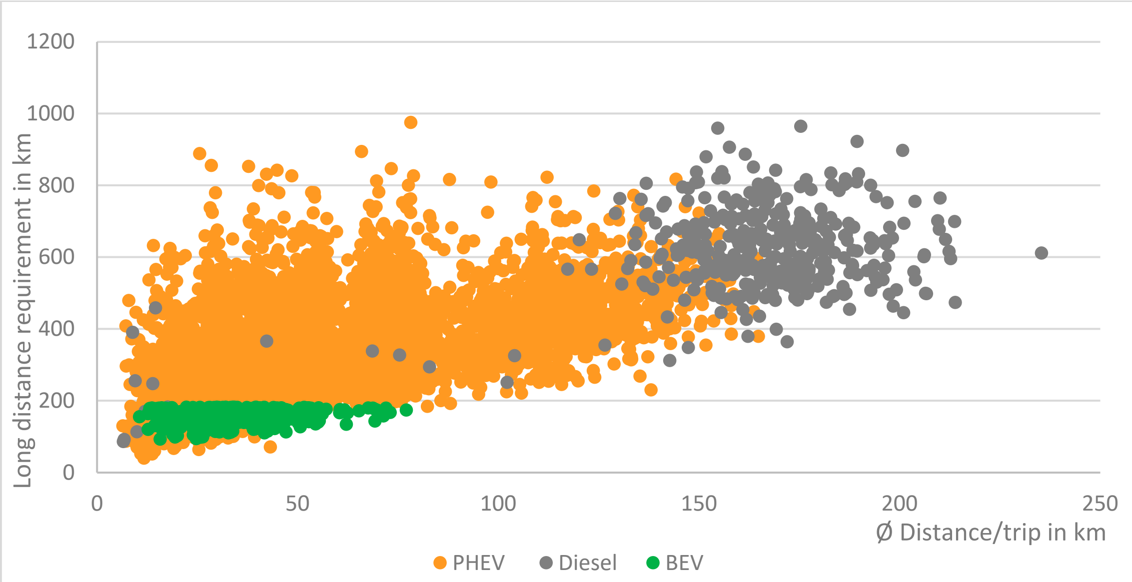

Figure S3 Environmentally optimal drivetrain type for compact segment in 2020

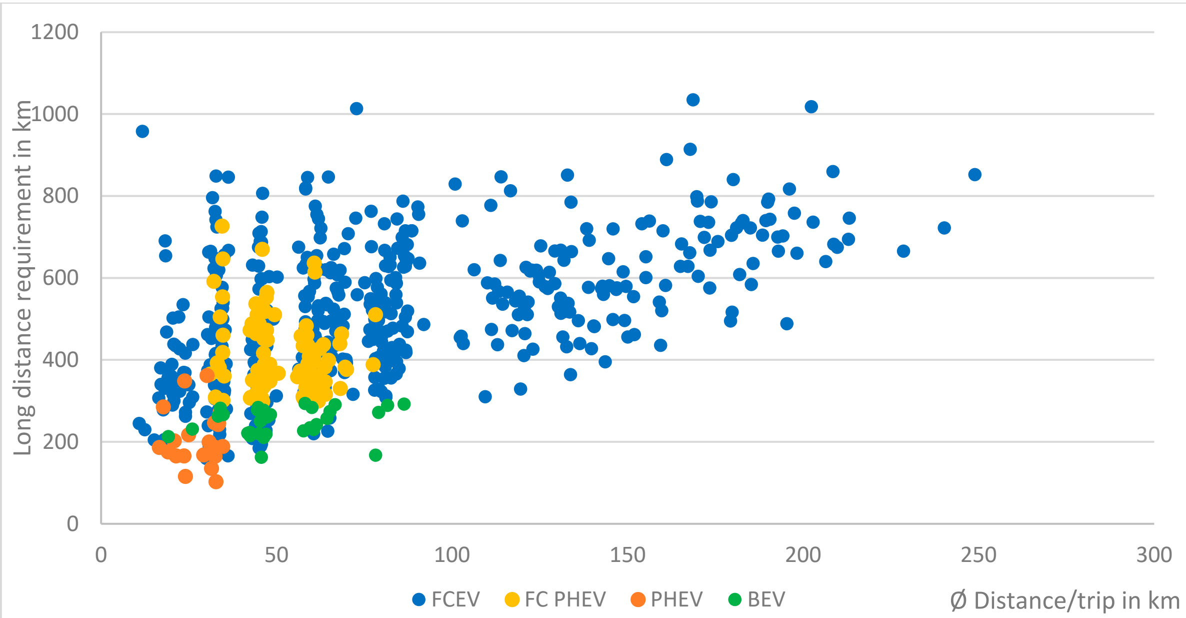

Figure S4 Environmentally optimal drivetrain type for SUV segment in 2020

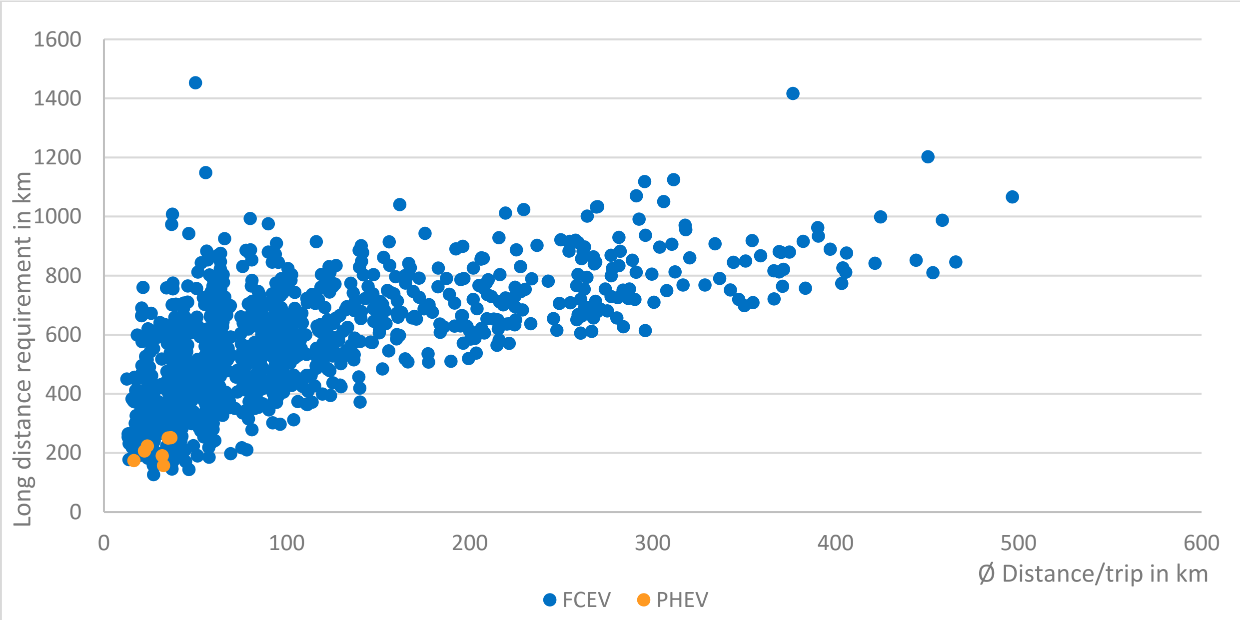

Figure S5 Environmentally optimal drivetrain type for mid-size segment in 2020

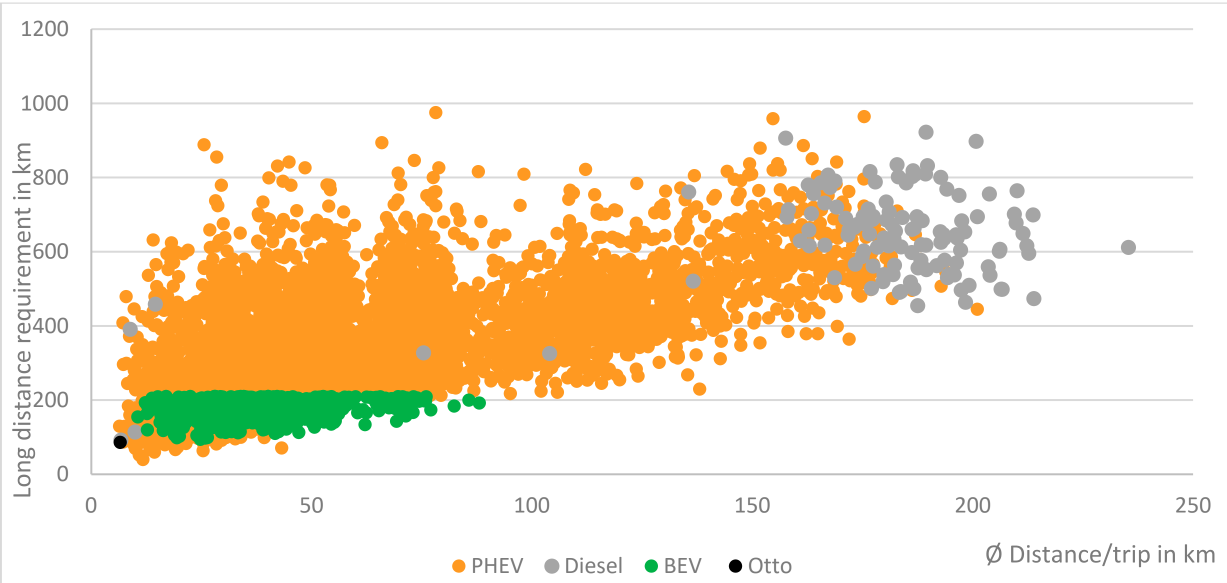

Figure S6 Environmentally optimal drivetrain type for compact segment in 2030

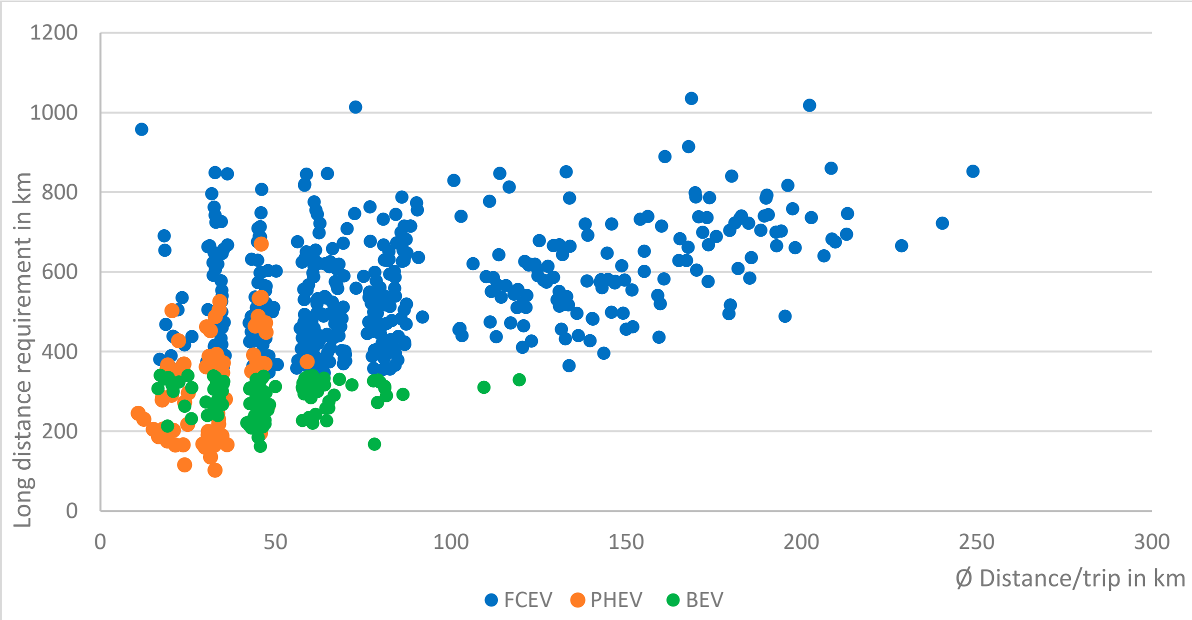

Figure S7 Environmentally optimal drivetrain type for SUV segment in 2030

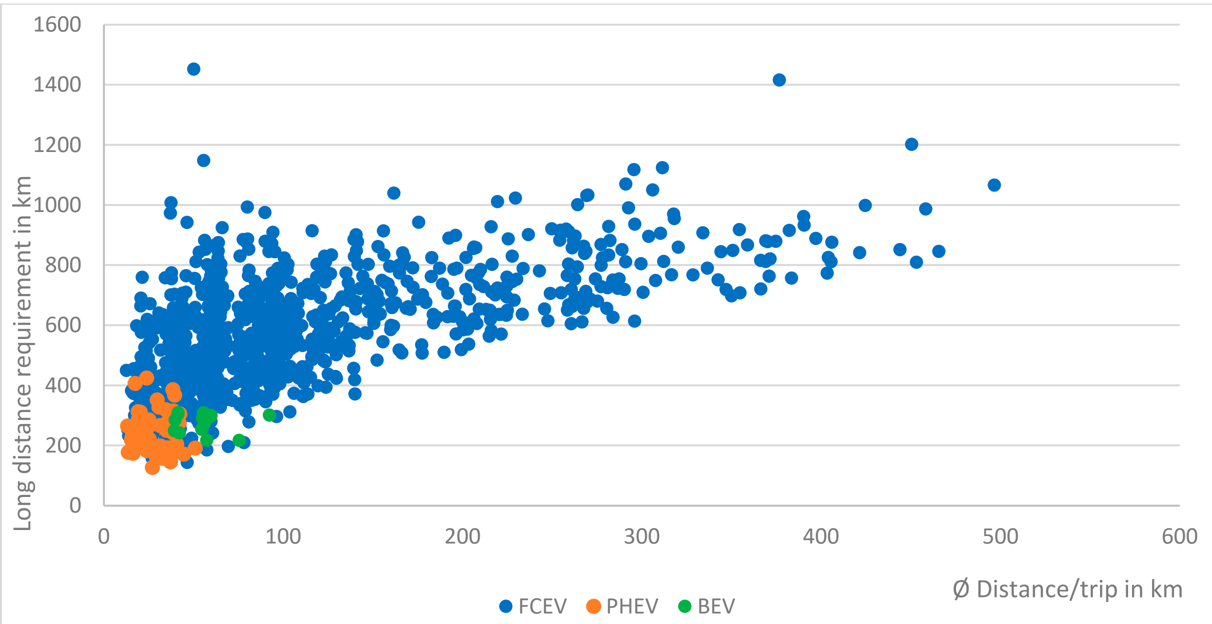

Figure S8 Environmentally optimal drivetrain type for mid-size segment in 2030

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