

Estimated energy consumption in NEDC (New European Driving Cycle)

--> http://en.wikipedia.org/wiki/New_European_Driving_Cycle

Basic calculation data

car	EVE-Smart 1
total vehicle weight (pass. + payload) in kg	915
drag coefficient cw	0,37
frontal area in m ²	2,1
rolling resistance coefficient cr	0,013
efficiency battery to wheels	0,81
efficiency gearbox (motor to wheels)	0,9
efficiency drivetrain (inverter to motor)	0,95
efficiency battery (battery to inverter)	0,95

acceleration energy : $E = \frac{1}{2} * m * (v_2^2 - v_1^2)$

energy for air resistance: $E = cw * A * 0,61 \text{ kg/m}^3 * v^2 * s$

energy for rolling resistance : $E = cr * m * 9,81 \text{ N/kg} * s$

energy for incline : $m * 9,81 \text{ N/kg} * h$ --> estimation here = round trip, i.e. no altitude difference (start = destination)

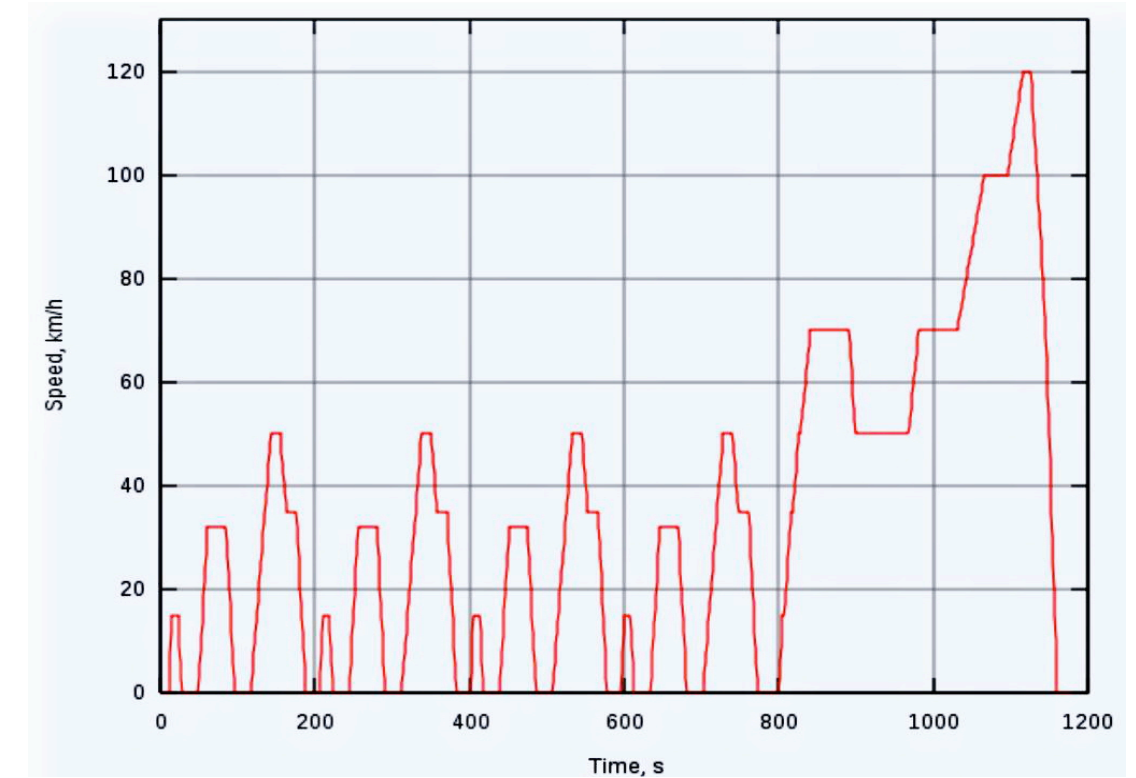
NEDC = 4 x ECE-15 city cycle + 1 x EUDC freeway cycle

1 x ECE-15 = ca. 0,97 km

1x EUDC = ca. 6,88 km

Total NEDC = ca. 4 x 0,97 km + 6,88 km = 10,76 km

needed energy from battery in total for 1 x ECE-15 (kWh)	0,068
needed energy from battery in total for 100 km ECE-15 (kWh)	7,039
needed energy from battery in total for 1 x EUDC (kWh)	0,886
needed energy from battery in total for 100 km EUDC (kWh)	12,976
needed energy from battery in total for complete NEDC (kWh)	1,159



Estimated range and energy consumption acc. to ECE-15 city driving cycle

Basic calculation data

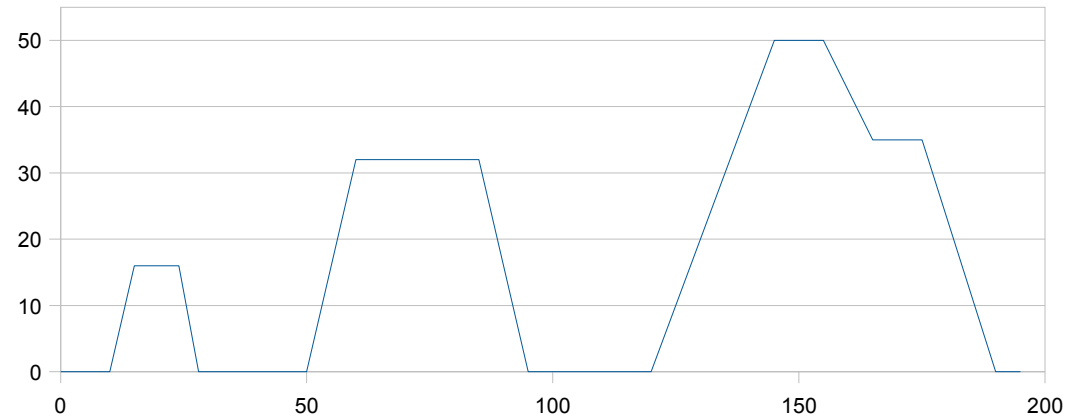
car	EVE-Smart 1
total vehicle weight (pass. + payload) in kg	915
drag coefficient cw	0,37
frontal area in m ²	2,1
rolling resistance coefficient cr	0,013
battery capacity 2 h discharge (80 % disch.) in kWh	4,3
efficiency battery to wheels	0,81
efficiency gearbox (motor to wheels)	0,9
efficiency drivetrain (inverter to motor)	0,95
efficiency battery (battery to inverter)	0,95

acceleration energy : $E = \frac{1}{2} * m * (v_2^2 - v_1^2)$

energy for air resistance: $E = cw * A * 0,61 \text{ kg/m}^3 * v^2 * s$

energy for rolling resistance : $E = cr * m * 9,81 \text{ N/kg} * s$

energy for incline : $m * 9,81 \text{ N/kg} * h$ --> estimation here = round trip, i.e. no altitude difference (start = destination)



City Driving Cycle acc. to ECE-15 of Economic Commission for Europe ; 1 x ECE-15 = ca. 0,97 km

driving time (s)	vehicle velocity (km/h)	distance (m)	needed energy at wheels for air + rolling resistance (kWh)	needed energy at wheels for acceleration (kWh)	needed energy in total from battery at wheels (kWh)	possible recuperation wheels to battery (kWh)
0	0	0,0	0,000	0,000	0,000	0,000
10	0	0,0	0,000	0,000	0,000	0,000
15	16	11,1	0,000	0,003	0,004	0,000
24	16	40,0	0,001	0,000	0,002	0,000
28	0	8,9	0,000	0,000	0,000	-0,002
50	0	0,0	0,000	0,000	0,000	0,000
60	32	44,4	0,002	0,010	0,014	0,000
85	32	222,2	0,010	0,000	0,012	0,000
95	0	44,4	0,002	0,000	0,002	-0,008
120	0	0,0	0,000	0,000	0,000	0,000
145	50	173,6	0,007	0,025	0,039	0,000
155	50	138,9	0,008	0,000	0,010	0,000
165	35	118,1	0,006	0,000	0,007	-0,010
175	35	97,2	0,004	0,000	0,005	0,000
190	0	72,9	0,003	0,000	0,003	-0,010
195	0	0,0	0,000	0,000	0,000	0,000
		971,8	0,043	0,037	0,098	-0,030

needed energy from battery in total for 1 x ECE-15 (kWh) 0,068

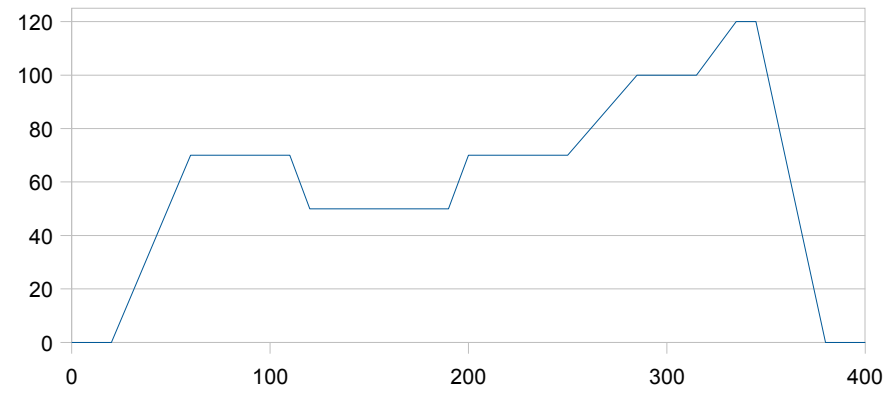
needed energy from battery in total for 100 km ECE-15 (kWh) 7,039

estimated city range acc. to ECE-15 (km) 61,089

Estimated range and energy consumption acc. to EUDC freeway driving cycle

Basic calculation data

car	EVE-Smart 1
total vehicle weight (pass. + payload) in kg	915
drag coefficient cw	0,37
frontal area in m ²	2,1
rolling resistance coefficient cr	0,013
battery capacity 2 h discharge (80 % disch.) in kWh	4,3
efficiency battery to wheels	0,81
efficiency gearbox (motor to wheels)	0,9
efficiency drivetrain (inverter to motor)	0,95
efficiency battery (battery to inverter)	0,95



acceleration energy : $E = \frac{1}{2} * m * (v_2^2 - v_1^2)$

energy for air resistance: $E = cw * A * 0,61 \text{ kg/m}^3 * v^2 * s$

energy for rolling resistance : $E = cr * m * 9,81 \text{ N/kg} * s$

energy for incline : $m * 9,81 \text{ N/kg} * h$ --> estimation here = round trip, i.e. no altitude difference (start = destination)

Freeway --> acc. to EUDC = Extra-Urban Driving Cycle ; 1x EUDC = 6,8 km

driving time (s)	vehicle velocity (km/h)	distance (m)	needed energy at wheels for air + rolling resistance (kWh)	needed energy at wheels for acceleration (kWh)	needed energy in total from battery at wheels (kWh)	possible recuperation wheels to battery (kWh)
0	0	0,0	0,000	0,000	0,000	0,000
20	0	0,0	0,000	0,000	0,000	0,000
60	70	388,9	0,018	0,048	0,081	0,000
110	70	972,2	0,081	0,000	0,100	0,000
120	50	166,7	0,012	0,000	0,014	-0,019
190	50	972,2	0,057	0,000	0,070	0,000
200	70	166,7	0,012	0,024	0,043	0,000
250	70	972,2	0,081	0,000	0,100	0,000
285	100	826,4	0,089	0,050	0,172	0,000
315	100	833,3	0,114	0,000	0,140	0,000
335	120	611,1	0,097	0,043	0,173	0,000
345	120	333,3	0,061	0,000	0,075	0,000
380	0	583,3	0,041	0,000	0,050	-0,114
400	0	0,0	0,000	0,000	0,000	0,000
		6826,4	0,661	0,165	1,019	-0,133

needed energy from battery in total for 1 x EUDC (kWh) **0,886**

needed energy from battery in total for 100 km EUDC (kWh) **12,976**

estimated freeway range acc. to EUDC (km) **33,137**

FREEWAY USE OF EVE-SMART 1 IS NOT RECOMMENDED (TOP SPEED 90 KM/H) !!!