


Sustainable energy use for transportation - Electricity

TOTAL COST OF OWNERSHIP


ASSUMPTIONS:

- 5 YEARS OWNERSHIP
- 15.000KM PER YEAR
- 70% HOME CHARGING, 30% EXTERNAL
- GERMAN PURCHASE PRICE, ELECTRICITY PRICE, SUBSIDIES, ETC.
- SALE OF THE VEHICLE AFTER 5 YEARS

PURCHASE



Model Y



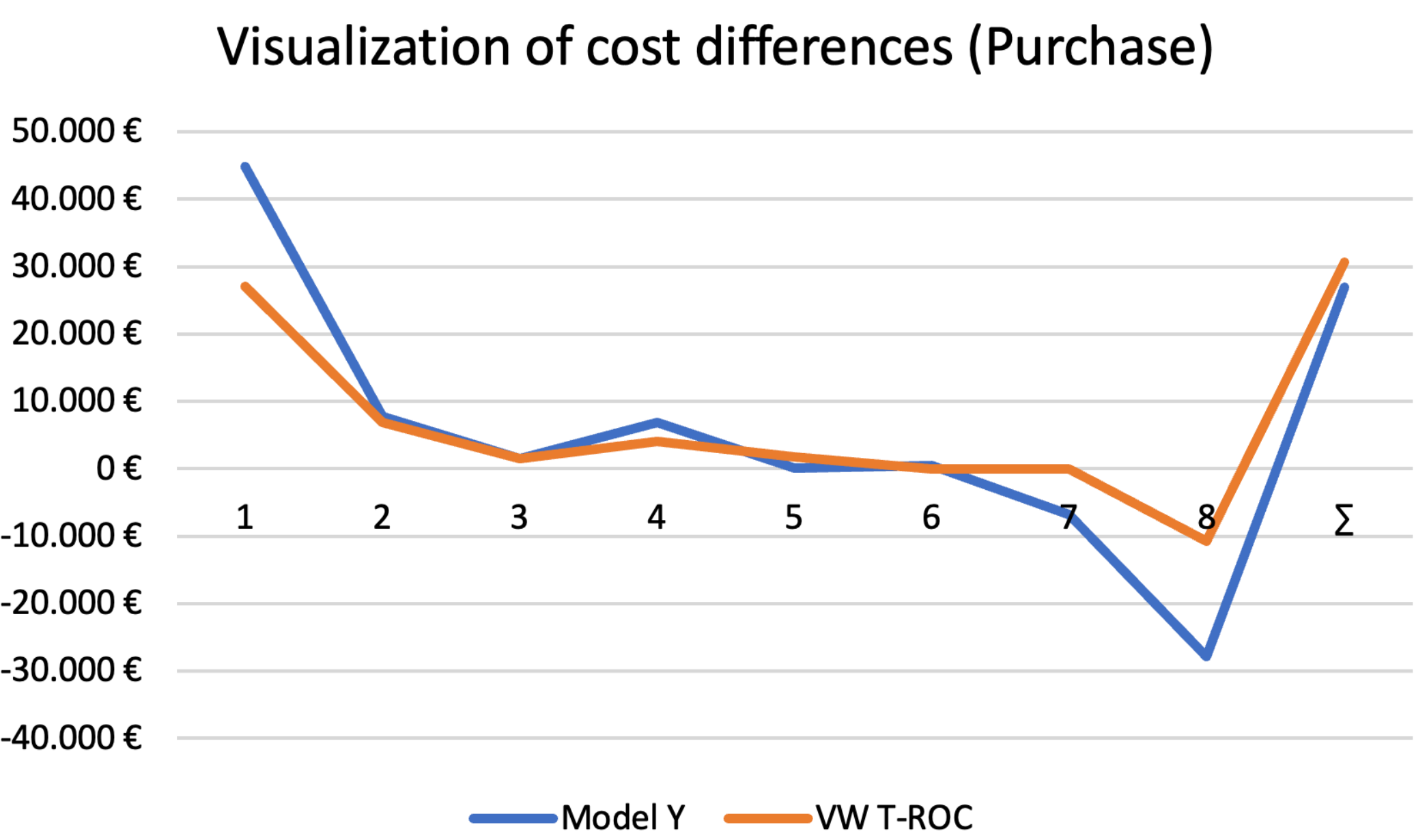
VW T-ROC

		Model Y	VW T-ROC
1	Purchase Price	44.890€	27.085€
2	Fuel or Electricity Costs	7.732€	6.937€
3	Maintenance and Repairs	1.451€	1.450€
4	Insurance	6.900€	4.020€
5	Taxes and Registration	75€	26,30€ + 1.790€
6	Charging or Refueling Infrastructure	500€	-
7	Incentives and Rebates	- 6.750€	-
8	Resale or Trade-In Value	-27.870€	-10.695€
	Total Cost (5 Years)	26.928€	30.614€

LEASING

		Model Y	VW T-ROC
1	Leasing p.M.	503€	299€
2	Leasing total (5Y)	30.180€	17.940€


Visualization of cost differences (Purchase)



Category	Model Y	VW T-ROC
1	44.890€	27.085€
2	7.732€	6.937€
3	1.451€	1.450€
4	6.900€	4.020€
5	75€	26,30€ + 1.790€
6	500€	-
7	- 6.750€	-
8	-27.870€	-10.695€
Σ	26.928€	30.614€

CONCLUSION:

- HIGHER INITIAL COST FOR EVS
- GOVERNMENT INCENTIVES FOR EVS
- EVS ARE SIMILARLY EXPENSIVE TO DRIVE (FUEL VS ELECTRICITY)
- INSURANCE COSTS ARE MORE EXPENSIVE DUE TO THE HIGHER POWER AND PURCHASE PRICE
- OVERALL COSTS ARE COMPARABLE

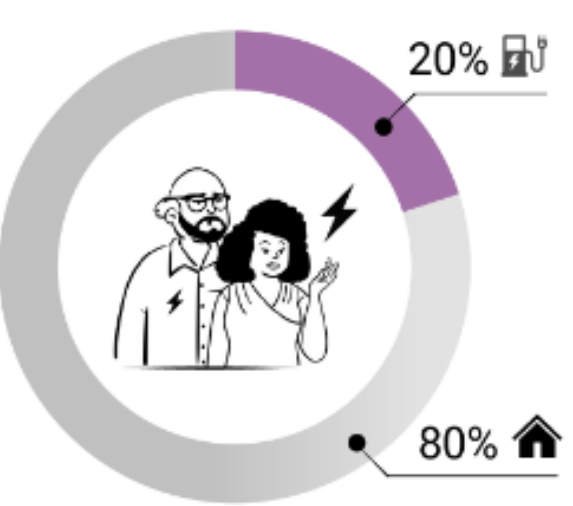


PRICE OF PUBLIC CHARGING

- +40% IN LAST 3 YEARS

John & Rosa

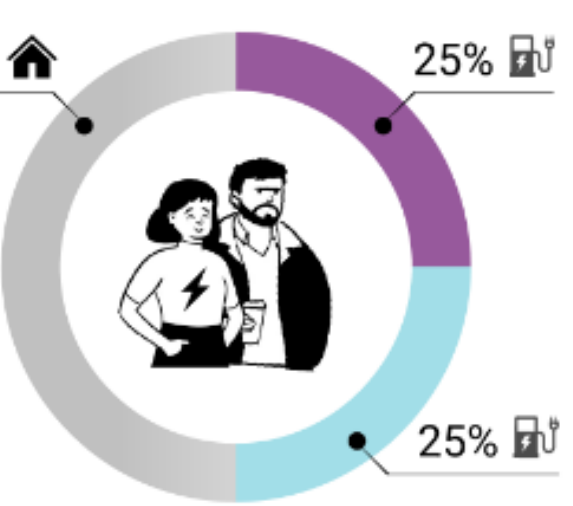
MOSTLY CHARGE AT HOME



Category	Cost
Home charging	1 216,31 €
Public charging	1 790,04 €
petrol/diesel	1 835,94 €

Michael & Marie

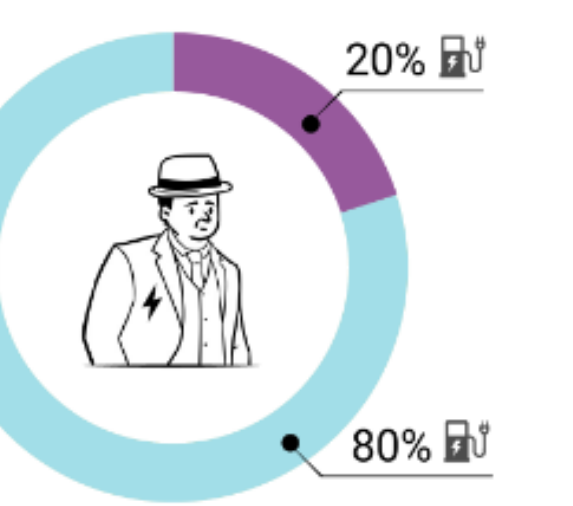
OFTEN CHARGE AT HOME



Category	Cost
Home charging	1 468,75 €
Public charging	1 790,04 €
petrol/diesel	1 835,94 €

Kris

NO HOME CHARGER



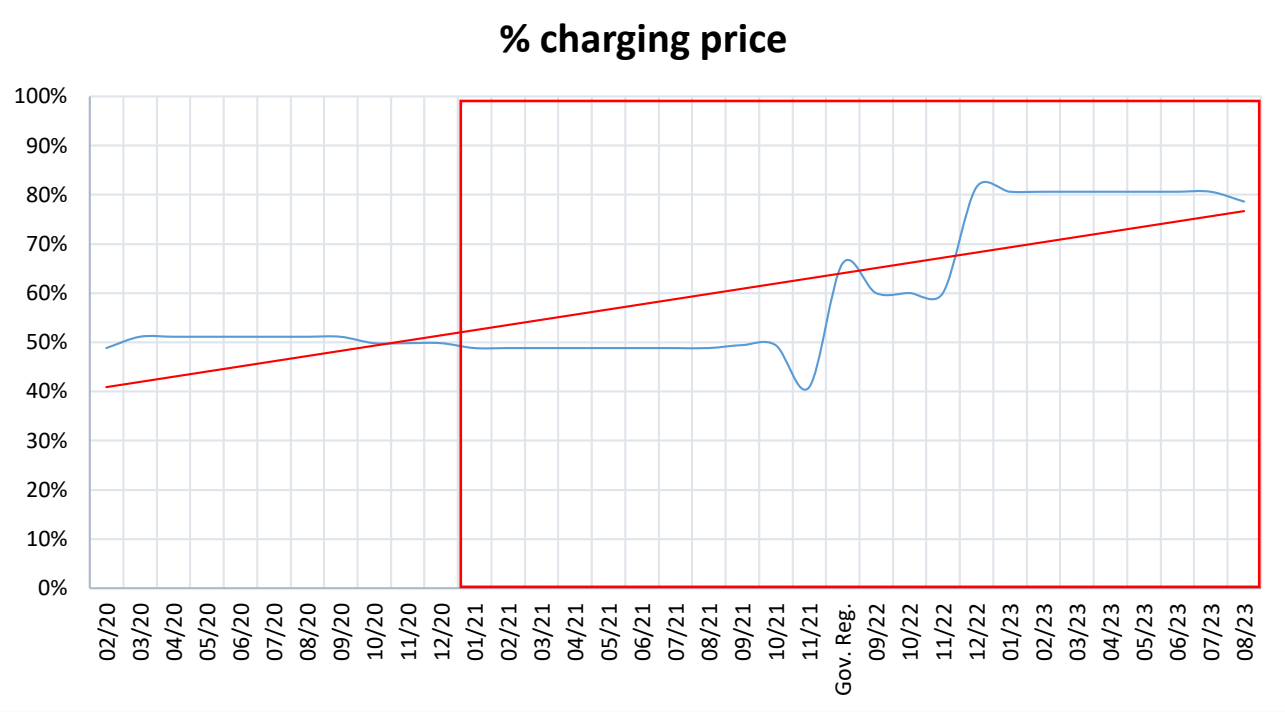
Category	Cost
Home charging	1 216,31 €
Public charging	1 790,04 €
petrol/diesel	1 835,94 €

Annual journey costs

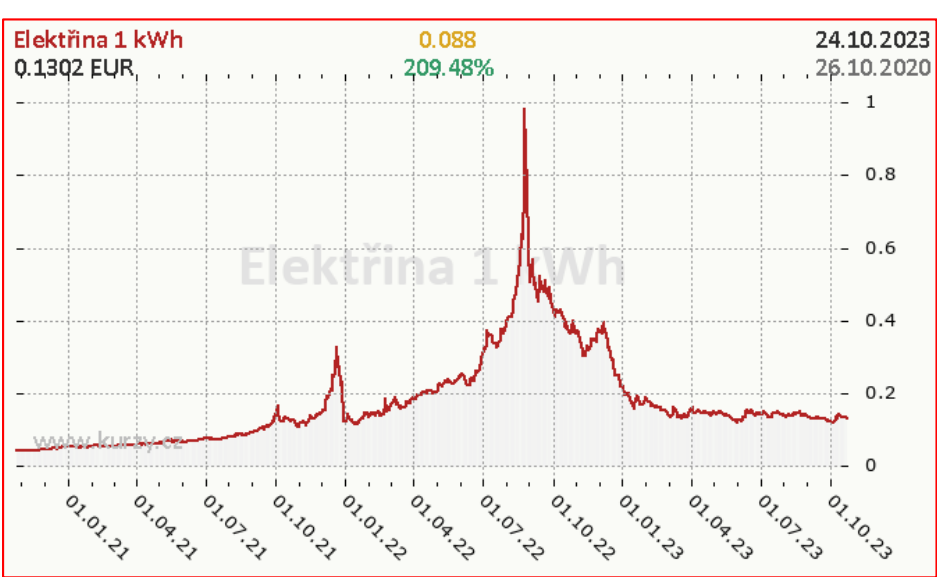
Category	Cost
John & Rosa	1 216,31 €
Michael & Marie	1 468,75 €
Kris	1 790,04 €
petrol/diesel	1 835,94 €

	Membership fee	AC per 1 kWh	DC per 1 kWh	User case 1: 200kWh AC; 50 kWh DC	User case 2: 50kWh AC; 200 kWh DC
PowerPass	Charge free	0,00 €	0,82 €	210,50 €	227,00 €
	Simply Charge	5,99 €	0,69 €	178,00 €	194,50 €
	Charge faster	15,99 €	0,65 €	167,50 €	182,50 €
PowerPass IONITY	Charge free	0,00 €	0,71 €	181,50 €	193,50 €
	Simply Charge	5,99 €	0,71 €	181,50 €	193,50 €
	Charge faster	15,99 €	0,50 €	130,00 €	145,00 €
ESB	Standard	4,79 €	0,51 €	131,10 €	142,65 €
	Pay-as-you-go	0,00 €	0,56 €	144,95 €	157,55 €
EasyGo	Prepay	0,00 €	0,50 €	125,00 €	125,00 €
	Pay-as-you-go	0,00 €	0,50 €	125,00 €	125,00 €
Ionity	Prepay	11,99 €	0,35 €	87,50 €	87,50 €
	Pay-as-you-go	0,00 €	0,79 €	197,50 €	197,50 €

% charging price

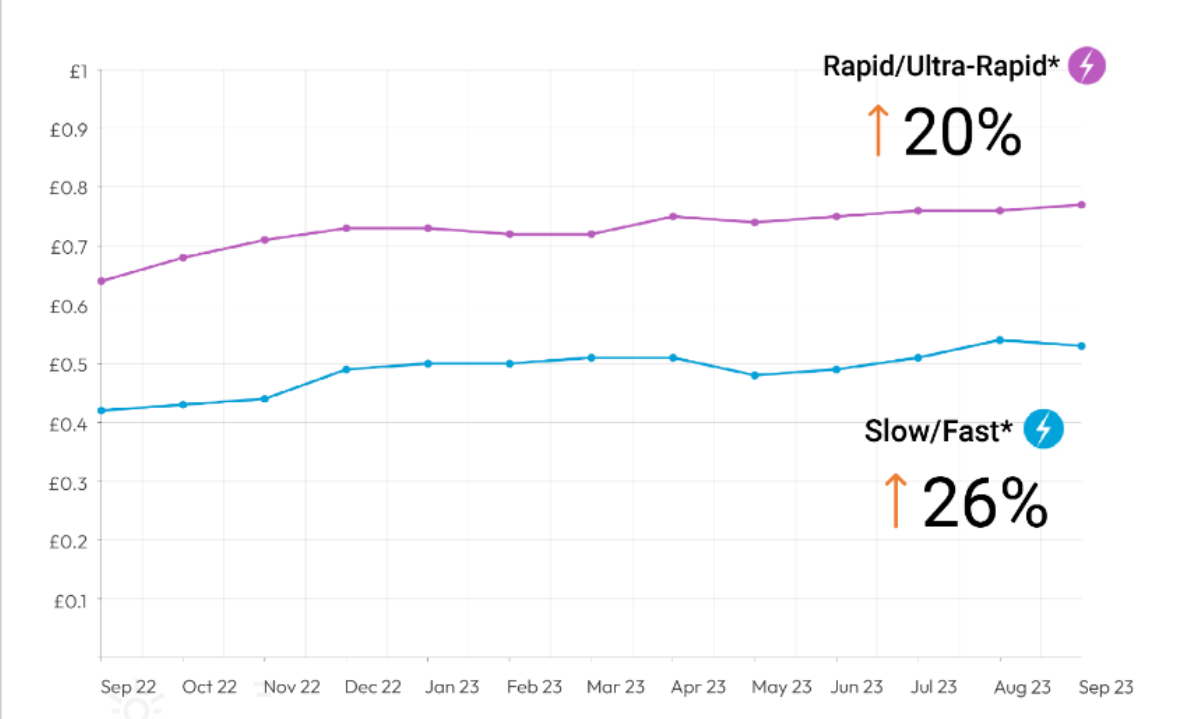


X HOUSEHOLDS PRICES



Price Index

Cost evolution: Sep 2022 to Sep 2023



ASSOCIATIE
KU LEUVEN

Sustainable energy use for transportation - Electricity

CHARGING EFFICIENCY

- **Mode 3 Charging (AC Slow):**
 - 80-95% efficiency with AC to DC conversion, resulting in 5-20% energy loss. These losses occur inside of ac/dc inverter and more specifically due to transistor internal resistance and heat.
- **Mode 4 Charging (DC Fast)**
 - Higher efficiency (90-95%) due to no AC to DC conversion by on-board charger, however ac is still converted to dc by charging station, but better efficiency is achieved by more efficient design. resulting in lower energy losses.

Key factors affecting efficiency

- CONVERSION OF AC to dc, by onboard charger or dc fast charging station.
- charging cable- resistance in the cable leads to energy loss
- ev battery- charging and discharging losses, including resistance heating.

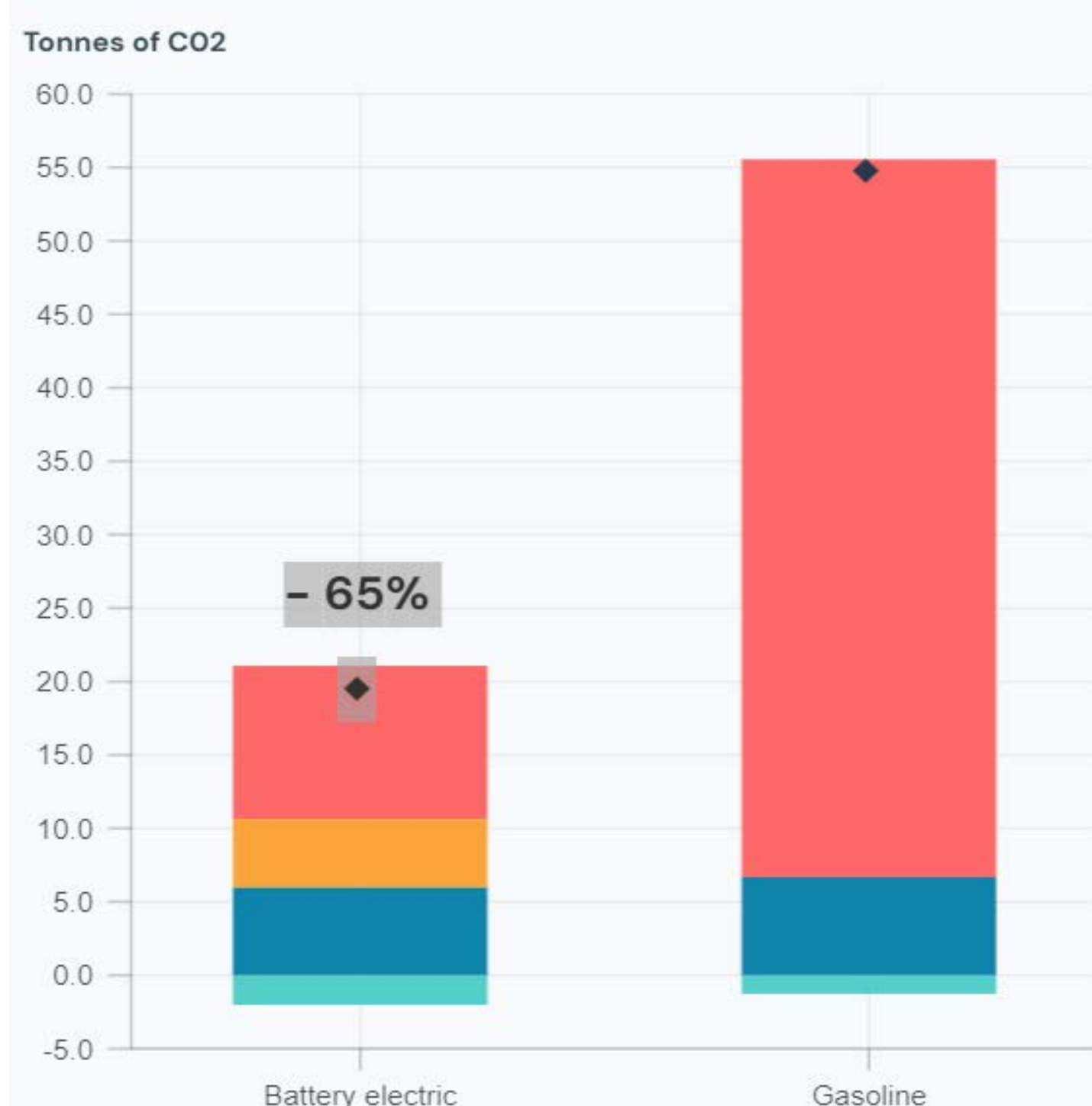
AC CHARGING



DC CHARGING

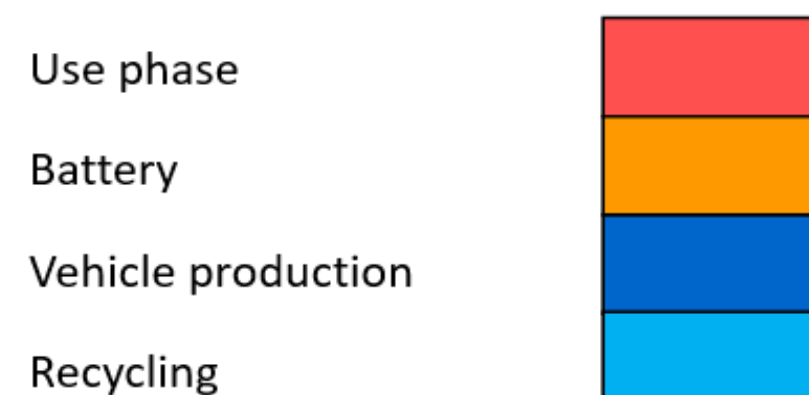


LIFE CYCLE CO2 EMISSIONS OF PASSENGER VEHICLES



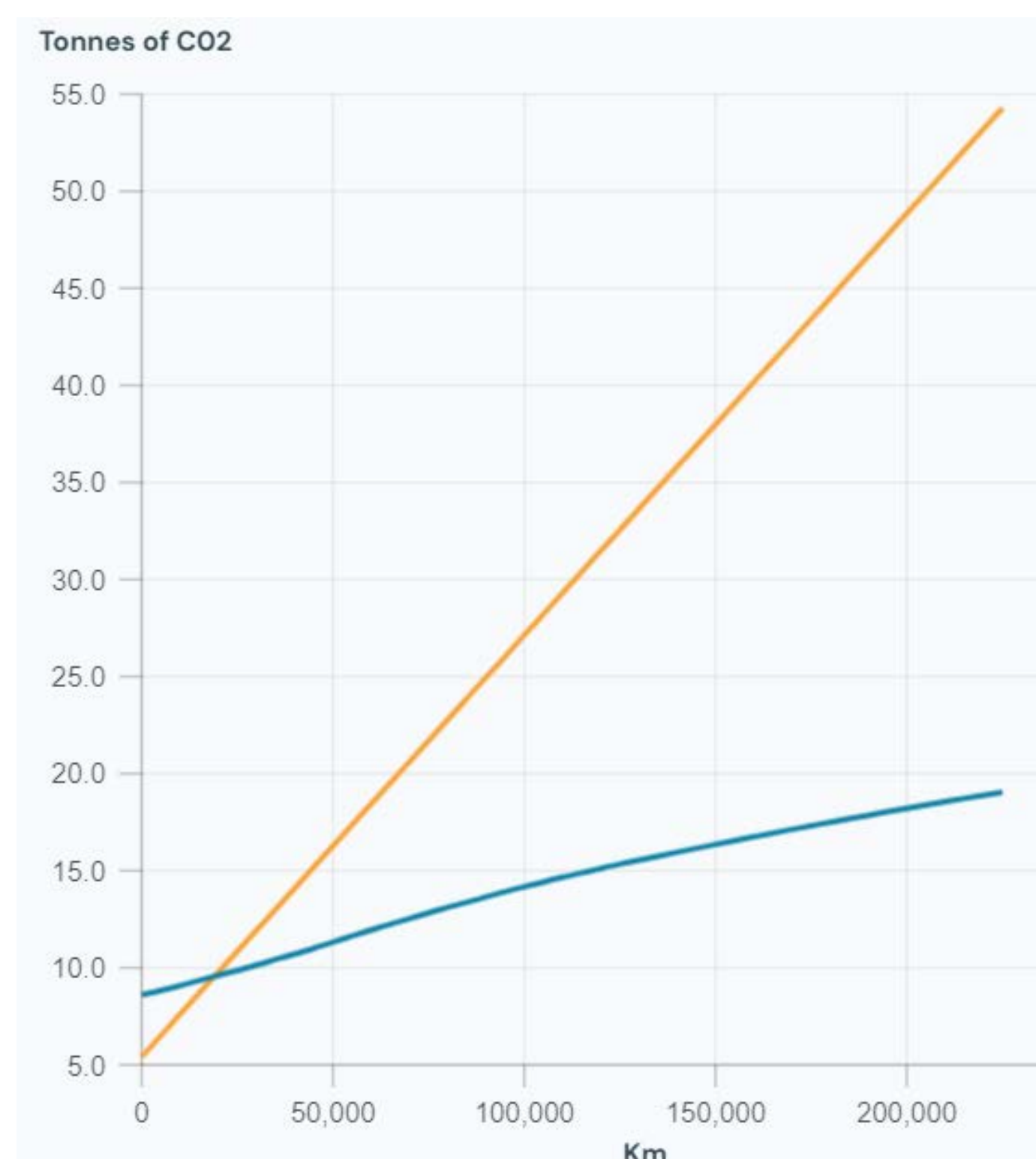
Minerals such as lithium, cobalt, and nickel, which are necessary for present-day EV batteries, must be mined and heated to high temperatures using fossil fuels. As a result, the construction of the 80-kWh lithium-ion battery contained in a Tesla Model 3 emits between 2.5 and 16 metric tons of CO₂.

Emissions:



	Electric Vehicle	Conventional Vehicle
Battery production	5.7	0
Vehicle production	7.2	5.7
Use phase including upstream	10.4	48.8
Recycling (Minerals and metals)	- 2	- 1.3

Statistics from the European Union's Department of Energy tell a similar story: Using a nationwide average of various energy sources, researchers discovered that EVs emit 1783 kgs of CO₂ equivalent per year, compared to 5187 kgs for petrol vehicles



DRIVE TRAIN EFFICIENCY

