

# Electric Loops - Reuse, Remanufacturing and Recycling of Electric Vehicles

Electric Vehicle Part		Reuse			Remanufacturing	Recycling*						
Part Name	Price sold for <sup>1</sup> (Days to sell)	Comparative Parts Pricing Average listing price <sup>2</sup>	Comparative Parts Demand No. of units no longer listed after 3 months <sup>3</sup>	Remanufacturing AN: Available Now F: Likely in the future	Weight (Kg) measured in study	Key factors/materials influencing value (e.g. copper content)	How material would likely be labelled for sale currently	Estimated value in todays market (€/tn)				
Battery	Battery <sup>4</sup>	€2000 (14 days)	Av. €2,967 from 27 li-ion listings. av. €755 from 3 NIMH listings from a mix of hybrid and BEV vehicles. Est. price per kWh €110-€120 per usable kWh for second hand battery pack. e.g. a 50kWh battery pack at 80% SOH, estimate €4,400.	12 of 30 Batteries	AN: Yes NIMH, No Li-ion F: Yes, challenges remain due to low standardisation	290 273	Cobalt, Lithium, Nickel and Copper	Li-ion Battery Negative				
	Electric Motor	Electric Motor & Reducer combined Externally Excited Synchronous Motors (EESM) <sup>5</sup>	Not listed for sale	Electric Motor: Av. €1,659 from 30 listings. Range: €288 (Kia Niro) to €6,900 (Porsche Taycan).	27 of 30 Motors	AN: No F: Yes, have potential for very long life	76.42	Copper, potentially Aluminium and Rare Earth Magnets (REMs) could become a key indicator of value, although not reflected in markets yet. Ferrous (e.g. Iron) contamination has the potential to reduce value. According to JRC <sup>6</sup> all HEV and PHEV e-drive motors are Rare Earth Permanent Magnet motors. 23% of BEVs have Rare Earth Permanent Magnet-free motors.	Electric Motors	€400-500 1tn - approx 15 units Value likely to be less if combined with gearbox. Price could increase per tn with further dismantling and segregation of motor components.		
Electric Motor Interior Permanent Magnet Synchronous Motor <sup>5</sup>		NS	60.94									
Reducer/Gearbox <sup>5</sup>		NS	28.87				Aluminium and Steel Ferrous contamination has the potential to reduce value.				Irony Aluminium	€350-450 1tn - approx 35 units
Inverters (& Rectifiers) and Converters	Inverter with Converter <sup>5</sup>	NS	Converter/Inverter: Av. €537 from 32 listings. Range: €144 (Toyota Prius) to €2,875 (BMW i8).	17 of 32 Converter/Inverter	AN: No F: Yes	11.54	Copper, Aluminium, and Printed Circuit Boards Ferrous contamination has the potential to reduce value.	Mixed Electronic Components or potentially a high quality Aluminium classification	€400-500 1tn - approx 60 units Prices varied significantly, based on casing materials and Printed Circuit Board quantity. Highest value quoted was €1380 per tn. One recycler suggested Charger Assembly w/Junction Box and Onboard Charger would contain more valuable elements than Inverters/Converters.			
	Traction Motor Inverter <sup>5</sup>	€304 <sup>1</sup> (261 days)	Inverter: Av. listing price of €412 from 10 listings. Range from: €170 (Toyota Auris) to €1,380 (Renault Kangoo).	4 of 10 Inverters	AN: No F: Yes	16.46						
	DC DC Converter	Not listed for sale	Converters: Av.€420 from 10 listings. Range: €71 (Toyota Yaris) to €1,150 (Kia Sportage).	8 of 10 Converters	AN: No F: Yes	15.21						
	Charger Assembly with Junction Box <sup>5</sup>	€1397 (251 days)	Onboard Chargers (OBC): Av. €540 from 10 listings. Range: €171 (MG ZS) to €885 (Mercedes Benz E Sprinter).	10 of 10 OBCs	AN: No F: Yes	26.38						
	Onboard Charger <sup>5</sup>	€750 (20 days)			AN: No F: Yes	16.39						
Control Modules	EV Specific Control Modules	NS	Difficult to identify EV specific control modules for sale. Examples found - BMS control unit (Jaguar IPACE) €153 and Convenience Charging Control Unit (BMW) €920.	2 of 4 Control Modules	AN: No F: Yes, software and coding will become important	0.52	Copper, Aluminium and Printed Circuit Boards	Mixed Electronic Components	€600-700 1tn - approx 1800 units			
Charging System	Charging Cable	NS €130 (73 days)	Av. €116 from 20 listings. Range: €40 (generic) to €184 (Tesla).	18 of 20 Charging Cables	AN: No F: No	2.57 1.62	Copper and potentially higher value metals at connections	Copper Cable or Mixed Electronic Components	€800-900 1tn - approx 660 units Depending on copper contents: <28% - <€1000 >28% and above - €1200 >60% - up to €3000 High voltage internal cable analysed in study was 17% copper.			
	Charging Socket	€145 <sup>1</sup> (37 days) NS	Av. €231 from 10 listings. Range: €144 (Mercedes C Class) to €362 (Porsche Taycan).	5 of 10 Charging Sockets	AN: No F: Yes	1.56 1.005						
	High Voltage Cables	Cable 1: €60 <sup>1</sup> (4 days) NS	Av. €143 from 20 listings of single Cables. Range: €18 (Skoda Citygo) to €276 (Renault Clio).	4 of 20 HV Cables	AN: No F: Yes	Cable 1: 1.37 Cable 2: 1.64 Cable 3: 0.18 Total: 3.19 2.19						
	Charger Flap	€130 (43 days) NS	Av. €162 from 6 listings. Range: €299 (Hyundai Kona) to €43 (Renault Kangoo).	3 of 6 Charger Flaps	AN: No F: Uncertain	0.90 1.09				N/A	Scrap Plastic	€150-200 1tn - approx 1100 units
		€274 <sup>1</sup> (35 days) NS	Av. €228 from 25 listings. Range: €71 (Toyota Prius) to €989 (BMW 330e).	5 of 25 AC Compressors	AN: Yes, alongside ICE versions F: Yes	6.29 6.64				Aluminium and Copper Ferrous contamination will determine the price.	Irony Aluminium, potentially Mixed Electronics Components	€300-400 1tn - approx 150 units
Thermal Management System	Battery Fan	NS	Av. €117 from 14 listings. Parts varied significantly in size with the Renault Zoe Fan larger than most.	7 of 14 Battery Fans	AN: No F: No	Not weighed	Plastic	Low value WEEE or Plastics	Low value - less than shell value			
	Coolant Lines	NS	Few comparable listings found. Coolant Return Hose from a BMW listed at €35 - €58.	1 of 5 Coolant Lines	AN: No F: No	1.94	Low value due to weight and material content.	Low value WEEE	Low value - less than shell value			
	AC Compressor or Heat Pump	€274 <sup>1</sup> (35 days) NS	Av. €228 from 25 listings. Range: €71 (Toyota Prius) to €989 (BMW 330e).	5 of 25 AC Compressors	AN: Yes, alongside ICE versions F: Yes	6.29 6.64	Aluminium and Copper Ferrous contamination will determine the price.	Irony Aluminium, potentially Mixed Electronics Components	€300-400 1tn - approx 150 units			
Electronics	Vehicle Sound Pedestrian (VSP) Speaker	NS	No others listed	N/A	AN: No F: No	0.545	Steel	WEEE	Up to €150, potentially negative value 1tn - approx 1200 units			
	Vehicle Sound Pedestrian (VSP) Control Unit	NS	No others listed	N/A	AN: No F: No	0.27	Steel and potentially Precious Metals	WEEE	Up to €300, potentially negative value 1tn - approx 1500 units			
	Display Unit Instrument Panel (Speedometer etc) <sup>5</sup>	NS	Av. €207 from 20 listings. Range: €57 (Nissan Leaf) to €1,087 (Jaguar IPACE).	12 of 20 Speedometers	AN: No F: Yes	0.63	Potentially Printed Circuit Boards and Critical Raw Materials Most recyclers considered it low value	WEEE or LED screen	On par with shell value 1tn - 1500 units			
Brakes and Steering	ABS Booster/ABS Pump Modulator	NS NS	Av. €167 from 7 listings. Range: €127 (Honda Civic Hybrid) to €210 (another Honda Civic Hybrid).	3 of 7 ABS	AN: No F: Yes	3.66 1.66 (2 units) 2.069	Steel and Aluminium	Irony Aluminium	€150-250 1tn - approx 400 units			
	Axle/Motor Subframe	€40 (1 section sold) (17 days)	N/A	N/A	AN: No F: e-axle - yes, other parts uncertain	34.90 18.68 (2 parts weighed)	Steel	Steel	€100 -120, on par with shell prices 1tn - approx 20 units			
Thermal Management System	PTC (Positive Temperature Coefficient) Heaters	€71 <sup>1</sup> (144 days) €247 <sup>1</sup> (1 day)	N/A	N/A	AN: No F: Yes	0.33 3.02	Aluminium and Copper Not examined	Irony Aluminium or potentially Mixed Electronic Components	€350 - 450 with one quote of €800 p/t 1tn - approx 600 units			
	Heating Resistor	€50 (97 days) NS	N/A	N/A	AN: No F: No AN: No F: No	0.14 0.13	Aluminium	Irony Aluminium or Dirty Aluminium	€300- 400 1tn - approx 7500 units			
		Power Steering Boxes/Steering Motor	NS NS	N/A	N/A	AN: No F: Yes	One unit weighed 10.8kg excl steering wheel, indicators etc.	Steel and Aluminium	Irony Aluminium	On par with shell value 1tn - approx 90 units		
Brakes & Steering	Brake Master Cylinder	NS	N/A	N/A	AN: No F: Yes	2.98	Steel and Aluminium	Irony Aluminium or Non-Ferrous	On par or below shell value 1tn - approx 350 units			
	Brake Pads	Not listed for sale			AN: No F: No	1.05	Steel	Steel	On par with shell value 1tn - approx 950 units			
	Brake Shoes	Not listed for sale			AN: No F: No	1.93	Steel	Steel	On par with shell value 1tn - approx 520 units			
	Brake Callipers	NS	N/A	N/A	AN: Yes F: Yes (not considered EV specific)	5.81	Steel	Steel	On par with shell value 1tn - approx 170 units			

## Parts Colour Key:

Only found in BEVs, HEVs or PHEVs
Different in a BEV than an ICE vehicle
May be different in a BEV to an ICE vehicle (depends on marque/model)

- Where parts were bought in GBP (Price sold for) or Listed (Comparative Parts Pricing) a conversion rate of 1.15 was applied to provide Euro value (avg. of previous 12 months). Prices include postage and are rounded to the nearest €. NS: Not sold during study period.
- Price data taken from eBay listings on a range of used parts from hybrid and electric vehicles. Postage excluded where possible.
- Data taken from eBay listings on a range of EV parts that were no longer listed 3 months after initial sample was taken. Initial listing date unknown.
- ELV Shell Prices: For comparison to the estimated prices provided for segregated parts, recyclers have provided ELV shell price estimates in the range of €115-150 per tn (December 2023). Part value estimates based on LME, European and Asian markets.
- Listed as one of the 19 parts that should be removed before shredding in the Proposal for a Regulation on circularity requirements for vehicle design and on management of End-of-Life Vehicles. See ATF report for more detail.
- JRC Report - N. Tazi, M. Orefice, C. Marmy, Y. Baron, M. Ljunggren, P. Wäger, F. Mathieux, May 2023, JRC SCIENCE FOR POLICY REPORT, Initial analysis of selected measures to improve the circularity of critical raw materials and other materials in passenger cars.

