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MRC RESEARCH BROADCAST

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BEV Insight

BEV Claims & Parts Prices

MRC Research on BEV

FROM THE RESEARCH DESK...

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Along with our regular MRC Technical eBulletin, we present another version of our technical publication called "MRC Research Broadcast". This publication serves as a platform for our research team to broadcast any specific research, technical guidelines or latest technological development from MRC own research team, MRC global research partners and counterparts, or from any relevant parties.

In this inaugural edition, we have selected the Battery Electric Vehicles (BEV) as the theme of our content and you will find the insight of this industry in Malaysia together with the recent BEV sales trend. We also provide information on the latest accident claim patterns. Moreover, we share updates on BEV parts prices, specifically for the selected BEV models and components. A comparative analysis of parts prices between BEV and Internal Combustion Engine (ICE) vehicles is also included for your perusal.

In addition, we are also sharing the information on various MRC researches on BEV sector in Malaysia including previous and ongoing studies.

Last but foremost, we also wish to highlight significant global developments to keep you abreast with global happenings especially around MRC partners and counterparts.

This endeavour has certainly been a passion project for us, and we trust that you will derive as much pleasure from reading it as we did from creating it.

CONTENTS

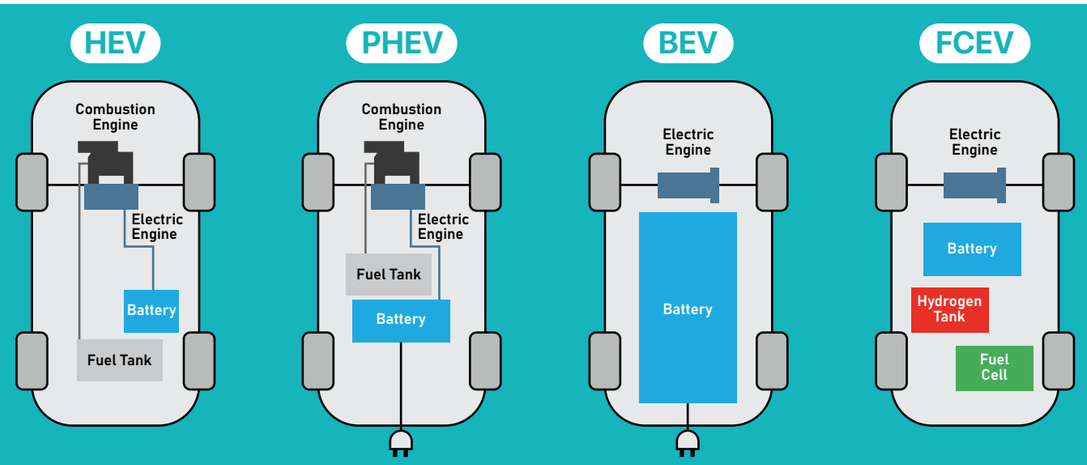
BEV INSIGHT

Battery Electric Vehicles in Malaysia

EV stands for Electric Vehicle. Electric vehicles are a class of vehicles that use electric motors for propulsion, instead of traditional internal combustion engines that run on gasoline or diesel.

There are different types of electric vehicles, including Battery Electric Vehicles (BEVs), which solely rely on rechargeable batteries; Plug-in Hybrid Electric Vehicles (PHEVs), which use a combination of externally rechargeable electric batteries and a gasoline or diesel engine; Hybrid Electric Vehicle (HEV), is a type of vehicle that combines a traditional internal combustion engine (usually gasoline or diesel) with an electric motor and Fuel Cell Electric Vehicle (FCEV) is a type of electric vehicle that uses hydrogen as its primary fuel source. FCEVs employ fuel cell technology, which combines hydrogen and oxygen to produce electricity, water, and heat.

EVs offer several benefits, such as reduced greenhouse gas emissions, lower operating costs, and a quieter driving experience compared to their conventional counterparts.



In Malaysia, the sales of Electric Vehicles are growing exponentially high beginning in early 2023. Vehicle manufacturers from China, Japan, South Korea, USA and Europe making their mark in this emerging industry.

For vehicle manufacturers from China especially, such as BYD, Chery, Geely, GWM and Neta, offer a range of affordable and eco-friendly BEVs with advanced technological features in the market.

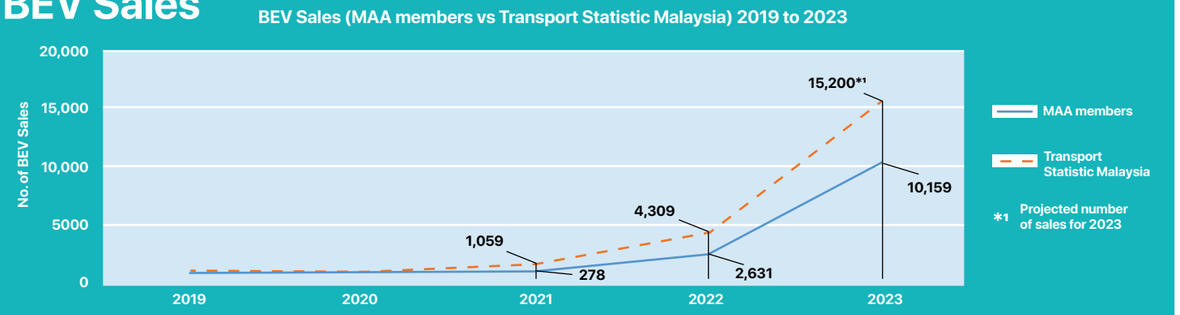
The Malaysian Automotive Association (MAA) sales data shows that the increased number of BEVs in Malaysia, along with the affordable and competitive price, will influence the BEV Malaysia market.

Sales of EV in Malaysia:

YEAR	HEV/PHEV (unit)	BEV (unit)	Total EV (unit)
2021	7,875	278	8,153
2022	19,988	2,631	22,619
2023	28,055	10,159	38,055

Source: MAA from MAA members' sales

BEV Sales



The chart displayed above illustrates the trend in BEV sales in Malaysia from 2019 to 2023. Data from MAA indicates a consistent increase in sales numbers for MAA members. In 2022, the Transport Statistics Malaysia reported all BEV sales in Malaysia reached 4,309 vehicles, quadrupling the previous year's figures.

The 2023 sales report is yet to be released, with an expected publication date in September 2024. Our forecast estimates that the number of BEV sales will reach 15,200***1**, taking into account the entry of a new BEV company from China into the Malaysian market.

This surge in BEV sales can be attributed to the introduction of more affordable models such as the BYD Dolphin, ATTO 3, Smart #1, and Ora Good Cat.

Looking ahead to 2024, we anticipate a significant increase in BEV sales with the launch of new models. BEV technology continues to evolve, with other sustainable propulsion technologies like hydrogen engines and ammonia (NH3) engines gaining attention. Manufacturers like Toyota and GAC are exploring these alternatives, noting that ammonia (NH3) may offer advantages over traditional hydrogen fuel cells in certain aspects.

As the automotive industry progresses, it is evident that vehicle propulsion technology is constantly evolving. The shift towards sustainable alternatives like hydrogen and ammonia engines promises reduced environmental emissions compared to traditional internal combustion engines.

BEV CLAIMS

Battery Electric Vehicles Claims 2023

BEV is a type of vehicle that is powered by an electric motor and relies on rechargeable batteries for energy. Just like any other vehicle, BEVs can also be involved in accidents. In recent years, there has been an increase in claims related to BEV accidents, particularly in the Integrated Claims and Automotive Portal (iCAP) transactions.

When it comes to accidents involving BEVs, there are specific factors to take into consideration. Firstly, the high voltage battery in the BEV can be damaged in the event of a crash. This damage can affect the performance and safety of the vehicle. The cost of repairing or replacing the battery may be covered by the vehicle's insurance policy, subject to the terms and conditions.

Additionally, the components of the high voltage system in BEVs are more expensive compared to traditional Internal Combustion Engine (ICE) systems. Even minor damages to these components can result in high repair costs.

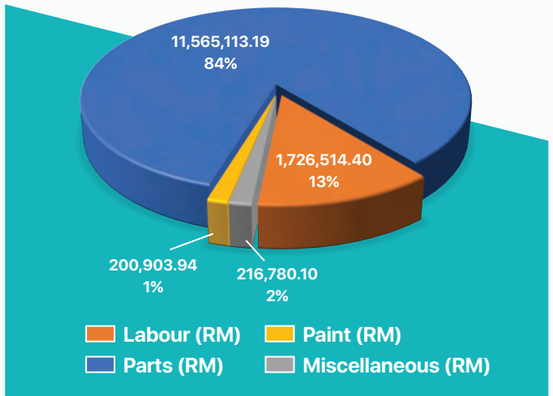
Determining liability in BEV accidents is similar to ICE vehicle accidents. If the driver of the BEV is at fault, their insurance policy will cover damages to the other vehicle and any injuries.

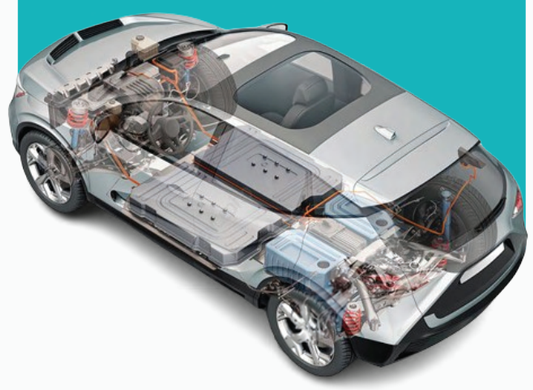
A study on BEV claims in 2023 showed that BEV claims accounted for only 0.12% (536 cases) of the total accident claims, which amounted to 459,760 claims.

Based on our details research on BEV claims, we can break-down the total cost to labor, parts, paint and miscellaneous. The breakdown cost details as table and pie chart below:

All claims	
No. of total claim cases	459,760
Total approved amount	RM3,823,158,531.90
Average cost per claim	RM8,315.55
ICE	
No. of total claim cases	459,224
Total approved amount	RM3,809,449,220.27
Average cost per claim	RM8,295.41
BEV	
No. of total claim cases	536
Total approved amount	RM13,709,311.63
Average cost per claim	RM25,577.07

BEV Claims Cost Breakdown (RM)

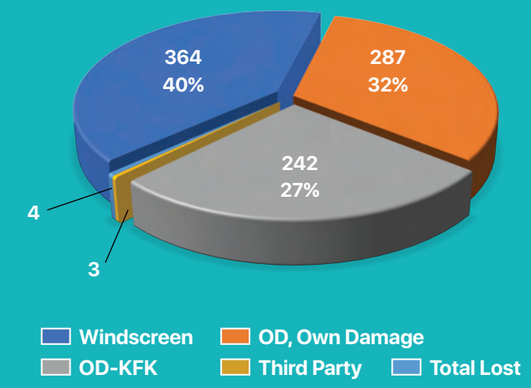




Battery Electric Vehicles Claims 2023

The pie chart displayed below illustrates the findings of the BEV claims survey conducted in 2023. This study was derived from MRC Malaysia's Integrated Claims and Automotive Portal (iCAP) and indicated a rise in the number of BEV vehicle accident claims, total 900. The data revealed that windscreen claims had the highest frequency in 2023 that comprises 40% from BEV claims, followed by Own Damage (OD) 32% and Own Damage Knock for Knock (OD-KFK) 27%. There were a few cases for Third Party and OD Constructive Total Lost (OD-CTL).

BEV Claims Study Jan - Dec 2023

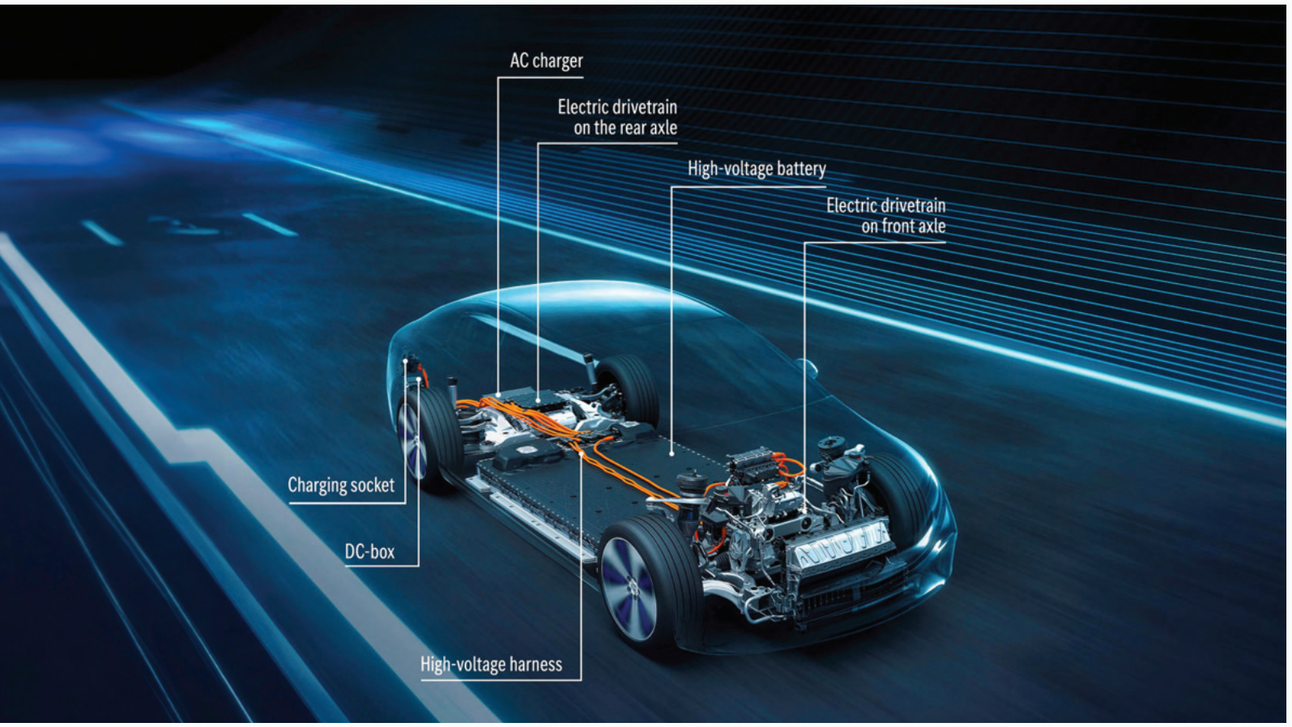


Claims Type	Number of Claims
Windscreen (WS)	364
Own Damage (OD)	287
Own Damage - KFK (OD-KFK)	242
Third Party	3
OD Constructive Total Lost - (OD-CTL)	4

Accidents involving BEVs can often result in higher costs than those involving ICE vehicles, primarily because of the intricate high-voltage electrical system and specialized components found in BEVs. Ultimately, the claims for BEV accidents tend to be pricier than those for ICE vehicle accidents, largely due to factors like the intricate high-voltage electrical system, specialized components, expenses for battery replacement, increased labor costs, and the relatively novel and underdeveloped supply chain for electric vehicle components.

	Labour (RM)	Parts (RM)	Paint (RM)	Miscellaneous (RM)	TOTAL
Total approved amount	1,726,514.40	11,565,113.19	200,903.94	216,780.10	13,709,311.63
Percentage Breakdown	12.59%	84.36%	1.47%	1.58%	

BEV PARTS PRICES



Selected Model Specific BEV Parts & Components Prices

Numerous components are related specifically to BEV. These include high voltage (HV) electronic control unit (ECU), HV traction motor, onboard charging system, HV AC compressor, battery cell modules, etc.

We have selected a few models of BEV for this analysis such as Audi Q8 e-tron S Line Quattro 55, BMW iX3 M Sport Impressive, Hyundai Kona EV e-Lite, Kia EV6 GT-Line, Mini Cooper EV SE Resolute, Mazda MX-30 EV High and Volvo XC40 EV Recharge P8. The parts price basket comparison between models could not be generated due to differences in systems equipped in different BEVs.

For continental BEV models, normally the HV battery comes in the configuration of 8, 10, or 12-cell modules within its battery system. For other BEV models such as models from China, normally it comes with a complete HV battery assembly. However, these complete battery assemblies are still not available at the vehicle manufacturers (VMs) end, thus no price.

Essentially, maintaining an inventory of HV batteries proves to be challenging as most VMs choose not to stock these batteries. Should these HV batteries be stored, their State-of-Health (SOH) would deteriorate over time.

On another note, for HV battery modules, the total price for complete HV battery assembly would be exorbitantly high. For example, the BMW iX3 uses a 10-cell module. The price of each cell module is RM19,836.76. Thus, the total prices for a complete HV battery assembly is RM198,367.60.

Audi Q8 e-tron S Line Quattro 55

• HV ECU	RM 34,620.00	• Traction Motor Rear	RM 59,560.00
• On Board Charger	RM 36,190.00	• Battery Junction Box	RM 31,130.00
• Battery Cover Panel	RM 92,850.00	• HV AC Compressor	RM 16,040.00

As at February 2023 MRCDB P74.0

BMW iX3 M Sport Impressive

• Traction Motor Rear	RM 48,651.38	• Battery Home Charger Cable	RM 3,097.71
• Motor Inverter Rear	RM 7,426.05	• Battery Cell Casing Lower Panel	RM 20,909.70
• Battery Cell Module	RM 19,838.76	• HV AC Compressor	RM 10,382.82

As at January 2024 MRCDB P85.0

Hyundai Kona EV e-Lite

• HV ECU	RM 13,309.00	• Traction Motor Front	RM 12,627.00
• On Board Charger	RM 11,910.00	• Charging Unit Front	RM 3,278.00
• Battery Cover Panel	RM 1,940.00	• HV AC Compressor	RM 2,341.00

As at February 2024 MRCDB P85.1

Kia EV6 GT-Line

• HV ECU	RM 6,085.50	• Traction Motor Rear	RM 25,825.50
• On Board Charger	RM 20,698.60	• Motor Inverter Rear	RM 23,182.00
• Battery Cell Module	RM 7,879.50	• HV AC Compressor	RM 8,167.90

As at January 2024 MRCDB P85.0

Mini Cooper EV SE Resolute

• HV ECU	RM 1,350.49	• Traction Motor Front	RM 20,763.53
• On Board Charger	RM 5,227.49	• Battery Home Charge Cable	RM 2,725.92
• Battery Cell Module	RM 13,277.58	• Battery Quick Charge Cable	RM 2,440.98

As at January 2024 MRCDB P85.0

Mazda MX-30 EV High

• Motor Mounting RH	RM 872.70	• Traction Motor Front	RM 40,948.80
• On Board Charger	RM 15,627.00	• Motor Mounting LH	RM 664.70
• Motor Rear Mounting LH	RM 504.90	• HV AC Compressor	RM 9,703.70

As at January 2024 MRCDB P85.0

Volvo XC40 EV Recharge P8

• HV ECU	RM 8,059.00	• Motor Inverter Front	RM 14,820.00
• Charging Unit Front	RM 10,493.00	• Traction Motor Rear	RM 30,467.00
• Battery Cell Module	RM 4,355.00	• HV AC Compressor	RM 11,092.00

As at November 2023 MRCDB P82.1

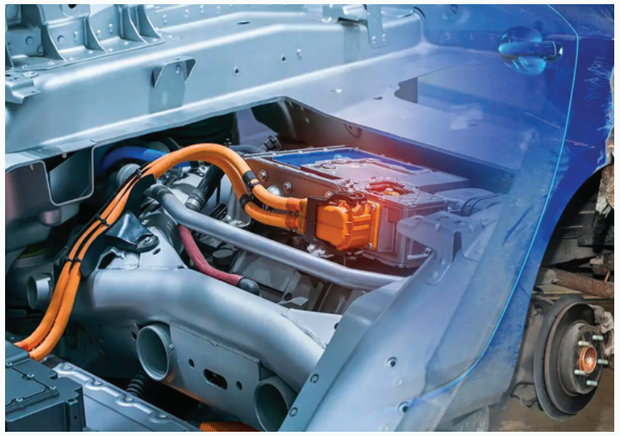
BEV PARTS PRICES

BEV vs ICE Vehicle Parts Price Comparison

In our parts cost study, we have chosen a few models for this analysis. In Malaysia, there are limited selection of models that incorporate both BEV and ICE.

The Audi Q8, Mini Cooper and Volvo XC40 have all features in both BEV and ICE variants. The Q8 e-Tron S Line 55 Quattro is the BEV model of the Audi Q8, while the Q8 TFSI Quattro represents its ICE variant. Similarly, the Mini Cooper's BEV option is the Cooper EV SE Resolute 2021, with the Cooper S (F56LCI 2018) serving as the ICE variant. For the Volvo XC40, the BEV model is the XV40 EV Recharge P8, and the XC40 R-Design is its ICE variant.

The selection of body parts and components is based on their common usage in the event of accident repairs. This illustration is to demonstrate the expense incurred in repairing a BEV if the BEV is involved in an accident.



To conclude, there is a considerable similarity between the repair cost of body repair and ADAS equipment. However, should the damage from the accident extend to the components of the electric vehicle, the cost of repairs would significantly escalate.

		Mini Cooper EV SE Resolute 2021 (BEV)	Mini Cooper S (F56 LCI) 2018 (ICE)
BEV	HV ECU Traction Motor Front On Board Charger Battery Cell Module (1)	TOTAL RM 40,619.09	TOTAL -
ADAS	Camera Front Screen Tailgate Rear Facing Camera	TOTAL RM 6,497.61	TOTAL RM 4,534.54
BODY REPAIR	Bumper Front Cover Bumper Frt. Reinforcement Panel AC Condenser Radiator Bonnet Headlamp Assy RH Door Front RH Fender Front RH	TOTAL RM 23,066.10	TOTAL RM 22,715.74
		RM 70,182.80	RM 27,250.28

		Audi Q8 e-Tron S Line 55 Quattro (BEV)	Audi Q8 TFSI Quattro (ICE)
BEV	HV ECU Traction Motor Rear Battery Cover Panel AC Compressor	TOTAL RM 203,070.00	TOTAL -
ADAS	Camera Front Screen Radar Front LH	TOTAL RM 7,890.00	TOTAL RM 7,890.00
BODY REPAIR	Bumper Front Cover Bumper Frt. Reinforcement Panel Bonnet Headlamp RH Fender Front RH Grille Front Radiator AC Condenser	TOTAL RM 77,380.00	TOTAL RM 98,770.00
		RM 288,340.00	RM 106,660.00

		Volvo XC40 EV Recharge P8 (BEV)	XC40 R-Design (ICE)
BEV	HV ECU Motor Inverter Front Charging Unit Front Traction Motor Rear	TOTAL RM 77,332.00	TOTAL -
ADAS	Radar Rear RH ECU ADAS	TOTAL RM 13,241.00	TOTAL RM 13,241.00
BODY REPAIR	Bumper Front Cover Bumper Frt. Reinforcement Panel AC Condenser Radiator Bonnet Grille Front Headlamp Assy RH Fender Front RH	TOTAL RM 32,410.00	TOTAL RM 30,854.00
		RM 122,983.00	RM 44,095.00

MRC RESEARCH ON BEV

BEV / HEV vs ICE Vehicle Collision Parts Study 2020

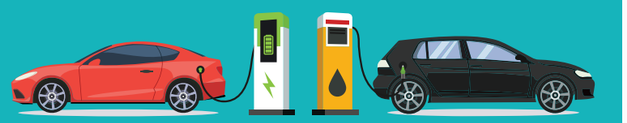
Malaysia is moving ahead to adapt new technology in the automotive industry by selling eco-friendly vehicles such as HEV and BEV vehicles. Presently, vehicle manufacturers have built and sold their HEV and BEV vehicles to the automotive industry market.

From this study, the data acquired from MRC iCAP from January 2019 to December 2019 contributed significant results for replacement parts of the selected HEV and ICE vehicles. The result summary is shown as below:

Hybrid Electric Vehicle

Internal Combustion Engine

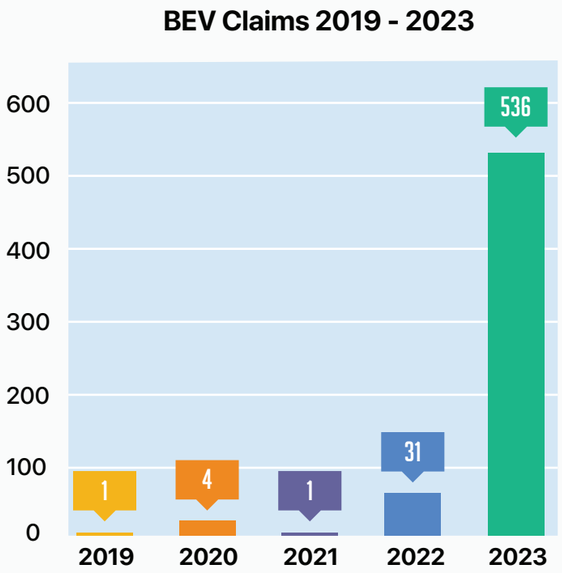
The HEV parts replacement price is up to **15%** more than ICE models, depending on the type of vehicle manufacturer.



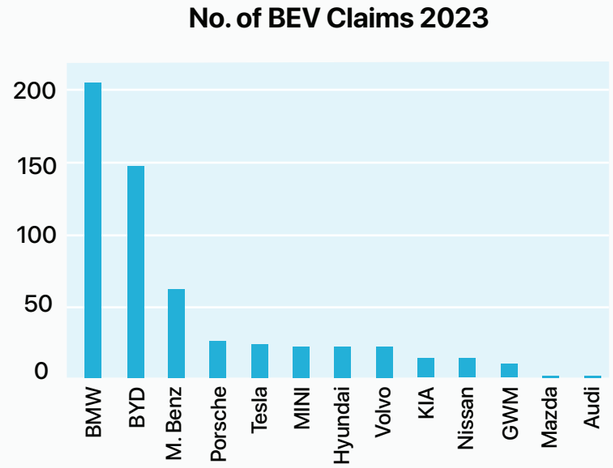
Nevertheless, this study conducted in 2020/2021 revealed that the presence of BEV in Malaysia was still notably scarce in the year of 2019. Instead of focusing on BEVs, HEVs were taken into account for these comparison against ICE vehicles.

BEV Claim Case Study 2024

Based on our previous study in 2020, we have revisited checking BEV claims by using additional approved accident claims data from 2020 to 2023 transacted through MRC iCAP.



Based on MRC iCAP, it shows a significant increase in BEVs accident claims in 2023. In conjunction with this BEV trend, MRC Malaysia has decided to conduct another in depth BEV accident claim study.



The study will explore current accident claims scenario of BEVs in Malaysia, delving into issues of BEV accidents and their repercussions, such as the impact of claim cost in BEV repair and the intricate of expensive BEV parts and components that can lead to total loss of BEV claims. The objectives of this study are;

- To analyse the latest BEV's new car sales and accident claims trend in Malaysia.
- To determine the impact of claim cost in BEVs repair.
- To determine the main BEV parts and components (e.g HV battery, motor inverter, traction motor and other parts) that can contribute to the total loss (BER) of the BEV.
- Claim case study on minor damage of under carriage that can contribute to total loss (BER).

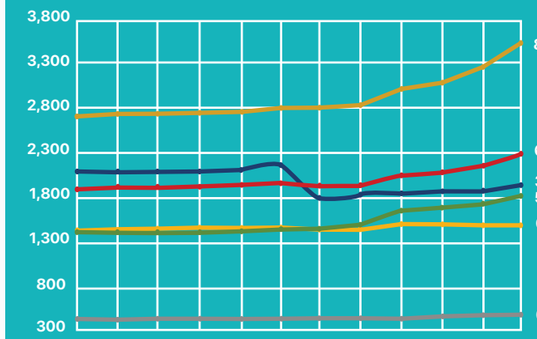
This study is still ongoing and expected to be completed in August 2024. The outcome of this study will be shared in the future edition of this publication.

BEV Parts Price Trend Analysis Report

MRC Malaysia provides periodic parts price reports to the industry. The reports include the quarterly Parts Price Trend Analysis reports and the biyearly Top 1,000 Parts Price Change reports.

For the upcoming Parts Price Trend Analysis Report Quarter 1, 2024, we will include a segment specifically to analyse BEV parts price trend for selected BEV models in Malaysia.

This new analysis will be current and in line with the latest models in our market.



Position Paper on the Reparability of High-Voltage Electric Vehicle Batteries

This article is extracted from the RCAR Newsletter January 2024 contributed by Allianz Center for Technology (AZT), Germany.

With the rise of electric vehicles (EVs) the number of accidents with at least one high-voltage vehicle involved, is increasing as well. As a result the question of reparability is coming into the spotlight. On one hand it is strongly influencing the sustainability of the technology, on the other hand it is driving cost of ownership and therefore attractiveness of buying EVs. To address those challenges AZT has published a position paper.

Based on our claims experience, we give recommendations on how to avoid expensive damages, e.g. by better protecting the high-voltage battery against underside damage. Second, in case of a damage, we line out how to improve reparability, for example by adjusting the battery design or improving access to battery data. We hope this position paper starts the discussion on the topic and as a result leads to more sustainable claims repair. The full text of the paper is available for download at:

EV battery boom: Second life or landfill?

This article is extracted from the RCAR Newsletter January 2024 contributed by Insurance Australia Group (IAG).

Overview

We are partnering with Edith Cowan University (ECU) through a cooperative research center called iMOVE to investigate the second lives of EV batteries. This project explores the current best practices for HEV battery second lives globally and aims to map out viable business models for repurposing batteries, based on existing local and international experience. While EVs currently represent just 1% of our insured vehicles, their volume is poised to surge in the coming years. By anticipating growth of EVs, we are acting early to ensure we're ready for this influx.

When a car assessed as unrepairable for Australian roads, it heads to salvage yards for auction, and in this regard, there's no difference for EVs. As part of the project, we are investigating the auction process for EVs to maximize salvage value. Specifically, the key focus of the project will be to investigate the following questions:

- What are the possibilities of a second life and how can we make them a reality?
- What drives the cost of this second life?
- What are the technical hurdles and leading reuse technologies?

Scope of work

Mainly, there are three project stages:

Stage I: Exploring EV Battery "Next Life" Possibilities: this stage will involve a comprehensive review of current and emerging practices for EV battery waste management, focusing on the 3Rs (Recycle, Refurbish, Repurpose) and their "next life" potential.

Stage II: Examining the Supply Chain for EV Battery "Next Life": this stage will map out the key players involved in the second-life market supply chain, including automotive manufacturers, battery performance testers, repurpose/remanufacturers, utility companies, and more. By drawing upon both local and international experiences, we aim to identify the crucial barriers and enablers for establishing a circular value supply chain.

Stage III: Evaluating Business Models for EV Battery "Next Life" Opportunities: second life batteries can play a key role in developing a sustainable renewable energy future and providing economic benefits to utilities, companies and consumers. During this stage, a desk top review of existing business models of EV batteries second life options will be conducted.

Global BEV Highlight

RCAR Design Guide for BEV

RCAR is an international body of automotive research centres, whose primary goal is to reduce the human and economic costs of motor vehicle losses. This is done through research into improved vehicle damage resistance, reparability, security and safety.

As a member of RCAR, MRC Malaysia has contributed some proposals to be added into RCAR Design Guide for BEV. The working group has accepted 3 of MRC Malaysia proposals i.e.

- High-Voltage Battery Lower Protection
- High-Voltage Grounding Cable
- Reinforced Side Sill or Rocker Panel

These proposals together with proposals from other members will be finalized by the working group. Once completed, the documents will be distributed to all BEV vehicle manufacturers globally.

Overall, this project aims to provide a comprehensive and insightful analysis of EV battery "next life" possibilities through a focused, research-driven approach. We invite you all to provide any input or direct us to similar work around the world in shaping a sustainable and profitable approach to second life of EV batteries and salvage.