

Info Sheet

The Right to Repair of Electric Vehicle Batteries

What is the right to repair?

The right to repair is a consumer rights movement advocating for individuals and independent repair shops to have access to the information, tools, and parts necessary to repair and maintain their own electronic devices without legal or technical restrictions.¹

Repairability is a central component to zero waste management systems that emphasize reuse and repairability before sending products for recycling. The Zero Waste Hierarchy provides a progression of strategies within the circular economy for eliminating waste and keeping materials in circulation.

The benefits to ensuring the right to repair for EV batteries include:

Extended Lifespan: The minerals and materials used to produce EV batteries have been extracted and refined at significant cost to the environment, health and livelihoods of frontline communities at extraction, refining and processing sites. Allowing repairs on EV batteries can help extend their effective lifespan, conserving resources, reducing the need for premature replacements and minimizing environmental impact.

¹ Autocare Association. n.d. "Massachusetts Right to Repair." Accessed May 6, 2024. <https://www.autocare.org/government-relations/current-issues/right-to-repair>.

Consumer Empowerment & Reduced Costs: An effective right to repair empowers consumers with knowledge, allows them to choose among multiple repair shops, fosters curiosity and tinkering, and reduces costs by making repair possible and more affordable, and not forcing them to buy a new vehicle.

Reduced Electronic Waste: By enabling individuals to repair and extend the life of their devices, the right to repair contributes to the reduction of electronic waste, which is crucial given that only 20 percent of electronic consumer and household products globally is properly handled.²

Job Creation: Supporting independent repair businesses and technicians can lead to job creation and boost local economies. Independently operated shops owned by people who live in the community also boost local economies by supporting business ownership, job creation and technical skills. Overall, reuse and repair creates as many as 30 times more jobs than landfilling.³

Savings for Consumers: The US Federal Trade Commission estimates that ensuring customers the right to repair broken products can save the average US family \$400 annually. And the ability to repair electronic devices could save American consumers \$50 billion a year and reduce 7 million tons of electronic waste.⁴

Serving Environmental Justice Communities: Low income and communities of color experience the heaviest financial burden from Original Equipment Manufacturer (OEM)'s restriction on third party repair activities. Over 50 percent of all auto repair services are independently owned,⁵ and predominantly located in US low-income communities.⁶ The independently owned shops provide critical phone, computer, automotive and appliance repair services to underserved communities and are positioned to play an important role in a just transition from fossil fuel transportation systems to electric vehicles.

² "UN Report: Time to Seize Opportunity, Tackle Challenge of e-Waste." 2019. UN Environment Programme. <http://www.unep.org/news-and-stories/press-release/un-report-time-seize-opportunity-tackle-challenge-e-waste>.

³ Eco-Cycle. n.d. "Jobs & Economic Benefits of Zero Waste." Accessed May 6, 2024. <https://ecocycle.org/learn-about-zero-waste/jobs-and-economic-benefits>.

⁴ The White House. 2023. "White House Convening on Right to Repair." Youtube, October 24, 2023. <https://www.youtube.com/watch?v=Ug3DkX7VRy8>.

⁵ Lindner, Jannik. 2023. "The Most Surprising U.S. Auto Repair Industry Statistics And Trends in 2024." Gitnux, December 16, 2023. <https://gitnux.org/u-s-auto-repair-industry-statistics>.

⁶ Federal Trade Commission. 2021. "Nixing the Fix: An FTC Report to Congress on Repair Restrictions." Federal Trade Commission, May 2021.

Challenges with battery repairability

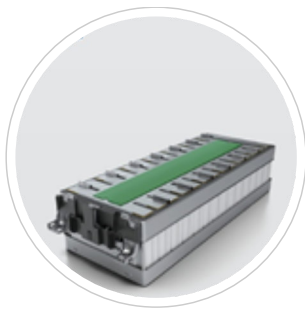
EV batteries risk having an artificially limited life in the vehicle given significant barriers to repair (as shown in Figure 1).

Repairs are challenging for technicians to carry out. Working on an EV requires additional training for auto mechanics to work on high-voltage equipment. Industry research shows that more than 50% of EV battery failures occur at the module-level, but only a few specialized refurbishment centers can potentially do these repairs (as illustrated in Figure 2).

Even if a repair is possible, it can be prohibitively expensive (in the range of \$10,000 or more), with long lead times for spare parts plus other considerations. Manufacturers may also require customers to use OEM brand dealers and repair services which are typically more expensive. The very high cost of repair means consumers or insurers often opt to scrap the vehicle instead of repairing it.

Repairs can be made impossible due to a range of technical design considerations. Original equipment manufacturers (OEM) of automobiles, computers and other products typically restrict repair of their products by using software locks, proprietary spare parts and requiring specialized tools necessary for independent shops or customers to make repairs on their own.

FIGURE 1: Issues of battery repairability



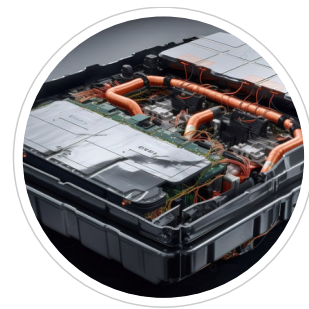
Technically challenging

More than 50% of battery failures occur at **module-level**, and only a few specialized refurbishment centers can repair this.



Prohibitively expensive

Even if repair is possible, it is prohibitively expensive. As a result, the vehicle is instead scrapped by the consumer or insurer.



Sometimes impossible

Repair is sometimes technically impossible when proprietary technology shuts the battery down, or when cells are bonded directly to the pack.

OEMs restrict repairs by employing the following tactics:⁷

- Product designs that complicate or prevent repair, such as cell-to-chassis or cell-to-pack construction, rather than modular construction;
- Unavailability of parts and repair information;
- Designs that make independent repairs less safe;
- Policies or statements that steer consumers to manufacturer repair networks;
- Application of patent rights and enforcement of trademarks;
- Disparagement of non-OEM parts and independent repair;
- Software locks and firmware updates; or
- End User License Agreements.

Other challenges include concerns about loss of revenue, technology misuse, and safety issues, especially with products containing hazardous materials.

- Manufacturers seek to balance intellectual property protection with regulatory requirements and consumer demands for greater control over their property.^{1,3}
- Concerns surround the risk of copied designs, chemical hazard exposure and threatened data privacy due to unprotected battery software.^{3,7}
- In response to these concerns, Extended Producer Responsibility (EPR) is gaining prominence, pushing manufacturers to assume responsibility for products throughout their lifecycle, including reparability. EPR plays a central role in the recently adopted EU Battery Directive.⁸

⁷ Ibid.

⁸ European Union. n.d. "Batteries." Accessed May 6, 2024. https://environment.ec.europa.eu/topics/waste-and-recycling/batteries_en.

FIGURE 2: Battery reparability by component level

Component level	Fault group	Repair difficulty	Local workshop	Regional service center	Refurbish center
Pack-level	BMS (Battery Management System)	[Increasing difficulty indicator]	?	✓	✓
	Electrical components		?	?	✓
	Thermal mgmt.		✗	?	✓
Module-level	Module		✗	?	?
			✗	✗	✓
	Cells		✗	✗	?

✓ Capable
? Select locations depending on capabilities
✗ Usually not capable

53% of EV battery failures occur here

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Overview of policies

The states of California, Colorado, Minnesota and New York have joined the governments of France and South Africa in passing guidelines and laws that protect the customers' right to repair their products. Thirty other states in the U.S. have also introduced the right to repair legislation, similar to California's Right to Repair Act,⁹ which gives independent repair shops and customers the right to access the tools and documentation necessary to make safe repairs on their devices. The French government went so far as to adopt a reparability index¹⁰ that scores products from 0-10.

Although most of the new Right to Repair laws target computers, phones and electronic devices, legislators are recognizing the growing problem with corporate practices of restricting repair, and have introduced right to repair laws in a variety of industrial sectors, including tractors and automobiles.¹¹

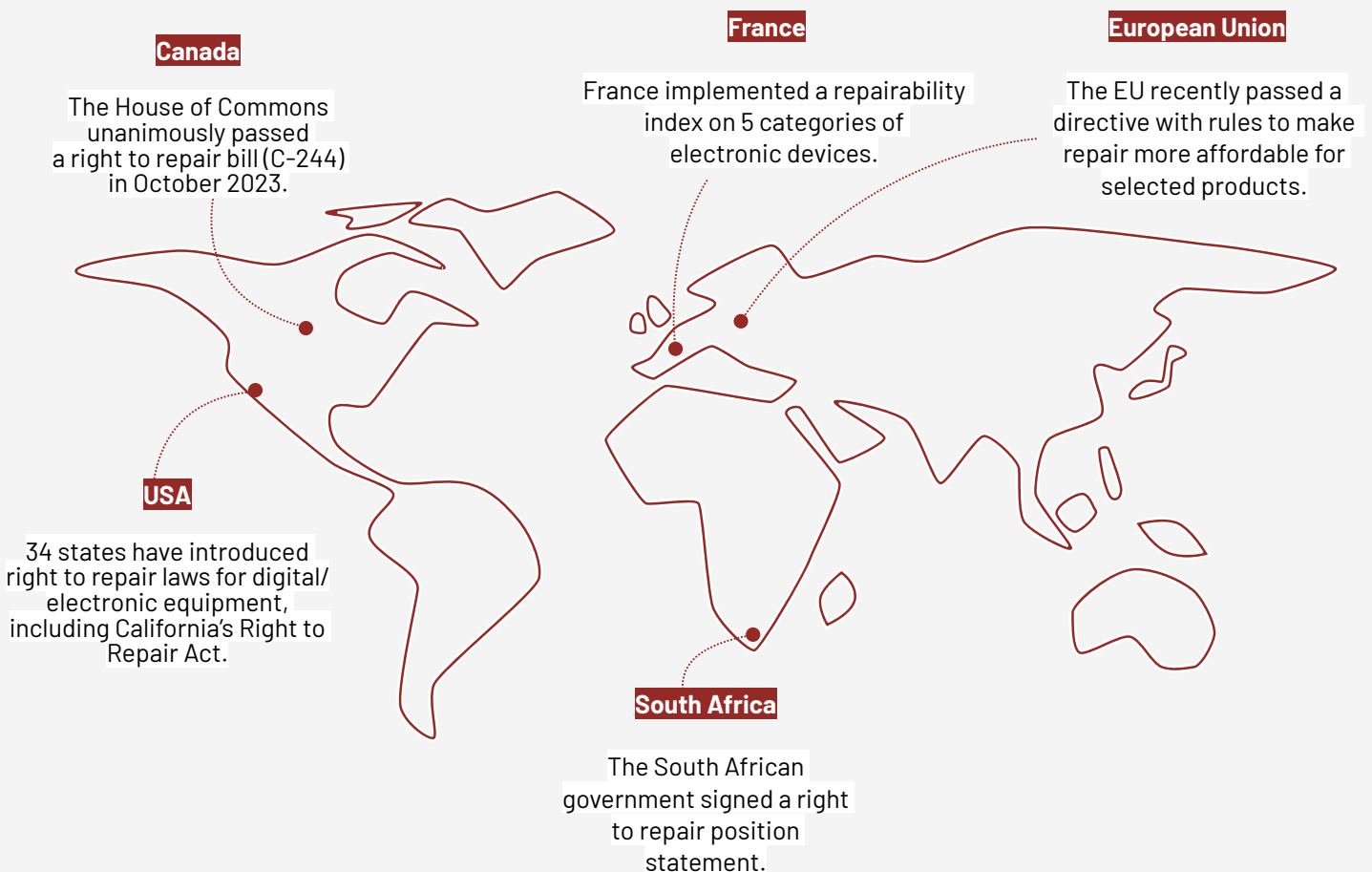
As shown in Figure 3, the following countries and states have taken steps to address the right to repair for consumer electronics and automotive vehicles:

⁹ Right to Repair Act, California Senate Bill No. 244, Chapter 704 (2023-2024), https://leginfo.ca.gov/leginfo/legislatre/ca.gov/faces/billTextClient.xhtml?bill_id=202320240SB244.

¹⁰ Right to Repair. 2021. "The French repair index: challenges and opportunities." Last modified February 3, 2021. <https://repair.eu/news/the-french-repair-index-challenges-and-opportunities>.

¹¹ (Federal Trade Commission, 2021).

FIGURE 3: Overview of countries leading with right to repair legislation



United States

United States: In 2021, President Biden signed an executive order encouraging the Federal Trade Commission (FTC) to establish rules limiting manufacturers from restricting consumers' ability to repair their own devices. The FTC has since been exploring regulatory frameworks. Furthermore, the EPA has voiced support for the right to repair.¹²

- **California:** In October 2023, Governor Gavin Newsom signed SB 244 requiring electronics manufacturers to provide tools, parts, software, and documentation for specific durations after production. This law is expected to have a domino effect across the United States, influencing similar regulations in other states.¹³ The law becomes operative on July 1, 2024.¹⁴
- **Colorado:** HB23-1011 specifically addresses agricultural equipment maintenance and repair.¹⁵
- **Maine:** Maine's legislature passed a bill that would require car manufacturers to share advanced repair data with car owners and independent mechanics through a standardized platform intended to reduce the cost of accessing the information needed to make repairs.¹⁶
- **Massachusetts:** In 2012, the state passed its first Right-to-Repair law, which guaranteed that every car owner had a right to have their vehicle serviced at the repair facility of their choice.¹⁷ Automakers then adopted telematics for wireless transmission of diagnostic data, eliminating the need for access through physical ports entirely. In 2020, Massachusetts voted to address this loophole and extend right-to-repair regulations to include telematics.¹⁸
- **Minnesota:** In May 2023, Minnesota passed the broadest right to repair law (SF 2744) yet through the Digital Fair Repair Act.¹⁹ The act requires "manufacturers of certain electronic products to make documentation, parts, and tools for diagnosis, maintenance, or repair available to independent repair providers and product owners on fair and reasonable terms."²⁰
- **New York:** New York became the first state to require Right to Repair strategies from manufacturers when Governor Kathy Hochul signed the Digital Fair Repair Act into law in December 2022.²¹

Canada

If Bill C-244 passes the Senate and goes through other legislative processes, individuals and independent repair companies would be permitted to break digital locks in order to make software repairs.²²

¹² The White House. 2023. "Readout of the White House Convening on Right to Repair." Statements and Releases. Last modified October 25, 2023. <https://www.whitehouse.gov/briefing-room/statements-releases/2023/10/25/readout-of-the-white-house-convening-on-right-to-repair>.

¹³ Rust, Susan. 2023. "California's new 'right to repair' law is embraced by recyclers." Los Angeles Times, November 8, 2023. <https://www.latimes.com/environment/story/2023-11-08/californias-new-fix-it-law-is-embraced-by-recyclers>.

¹⁴ Right to Repair Act, California Senate Bill No. 244, Chapter 704 (2023-2024).

¹⁵ Consumer Right to Repair Agricultural Equipment Act, Colorado General Assembly Bill 23-1011 (2023), <https://leg.colorado.gov/bills/hb23-1011>.

¹⁶ Neufeld, Kay. 2024. "Lawmakers move to undo parts of Maine's new automotive right to repair law." Portland Press Herald, February 14, 2024. <https://www.pressherald.com/2024/02/13/lawmakers-back-amendments-to-maines-new-automotive-right-to-repair-law>.

¹⁷ (Autocare Association, n.d.)

¹⁸ Song, Nick. 2023. "Lawmakers move to undo parts of Maine's new automotive right to repair law." Main Public, November 7, 2023. <https://www.mainepublic.org/politics/2023-11-07/question-4-overwhelmingly-passes-protecting-mainers-auto-right-to-repair>.

¹⁹ Povich, Elaine S. 2023. "Minnesota's new 'right to repair' law is the broadest one yet." Minnesota Reformer, May 30, 2023. <https://minnesotareformer.com/2023/05/30/minnesotas-new-right-to-repair-law-is-the-broadest-one-yet>.

²⁰ The Office of Minnesota Attorney General. n.d. "The Right to Repair in Minnesota." Accessed May 6, 2024. <https://www.ag.state.mn.us/Consumer/Publications/RightToRepair.asp>.

²¹ New York State. 2022. "Governor Hochul Signs the Digital Fair Repair Act Into Law." Last Modified December 29, 2022. <https://www.governor.ny.gov/news/governor-hochul-signs-digital-fair-repair-act-law>.

²² CBC News. 2023. "Looking for a fix: Canadian bill boosts right to repair movement." CBC News, November 9, 2023. <https://www.cbc.ca/news/science/what-on-earth-right-to-repair-canada-1.7023762>.

Europe

European Union: The EU recently passed a directive with rules to make repair more affordable for selected products by supporting independent repair and improving consumer access to affordable repair options.²³

- Reasonable prices set for original parts
- Ban on software practices preventing independent repair and the use of compatible and reused spare parts

This rule is only applicable to products with reparability requirements. For these few product categories, manufacturers will now be obligated to provide repair options beyond the standard two-year legal warranty period.

The EU Commission will launch a European online platform that lists repair and buyback options across Member States, along with standardized quotes, enhancing visibility and cost transparency for repair solutions.

The EU has also recently proposed standardized USB-C ports for electronic devices.²⁴

France: France is the first country in Europe to have implemented a reparability index on 5 categories of electronic devices including smartphones, laptops, televisions, washing machines. The reparability index scores products on a scale 1-10 based on availability and price of spare parts, access to documentation and ease of disassembly among other things.²⁵

Africa

The South African government signed a right to repair position statement. The statement supports the core beliefs of the right to repair movement and outlines 10 best practices that support the development of the right to repair framework that can be adopted into possible legislation.²⁶

Electronic and computer companies are responding to new laws and loosening the restrictions on repair. However, leading automakers are continuing to fight in court to monopolize repair services for their cars. Automotive OEMs are requiring customers to use OEM-produced parts and preventing the use of aftermarket parts on their vehicles.²⁷ Aftermarket parts are produced by a different parts company and are often designed to be compatible with as many makes and/or models as possible. Access to aftermarket replacement parts is critical to extending the life of a battery and supporting independent repair services, especially those in remote regions.

Luckily, the global right to repair movement is successfully passing laws and pushing against premature obsolescence and OEMs monopoly on repair services.

²³ "Rules Promoting the Repair of Goods." 2023. European Commission. https://commission.europa.eu/law/law-topic/consumer-protection-law/consumer-contract-law/rules-promoting-repair-goods_en#what-are-the-next-steps.

²⁴ Rajan, Manoj and S Ramachandran. 2024. "The Right to Repair and A New Era of Sustainability." Infosys, November 24, 2021. <https://www.infosys.com/iki/perspectives/new-era-sustainability.html>.

²⁵ "The French Repair Index: Challenges and Opportunities." 2021. Right to Repair Europe (blog). February 3, 2021. <https://repair.eu/news/the-french-repair-index-challenges-and-opportunities>.

²⁶ MIWA. 2023. "MIWA joins the Global Right to Repair Movement for Vehicles." Last modified April 4, 2023. <https://www.miwa.org.za/blog/miwa-joins-the-global-right-to-repair-movement-for-vehicles>.

²⁷ Thompson, Michelle. 2023. "Tesla victorious in lawsuit accusing it of parts, repair monopoly." Repairer Driven News, November 28, 2023. <https://www.repairerdrivennews.com/2023/11/28/tesla-victorious-in-lawsuit-accusing-it-of-parts-repair-monopoly>.

Recommendations on the right to repair of EV batteries

While our knowledge base continues to evolve, some emerging demands to protect the Right to Repair of EV Batteries include:

- **Access to Information, Diagnostic Tools and Repair Manuals:** The right to repair EV batteries would involve granting universal and fair access to diagnostic information, battery state of health, technical manuals, spare parts and tools necessary for repair. Access to diagnostic tools for EV batteries would enable efficient identification and resolution of issues.²⁸
- **Removal of Barriers:** Remove any firmware, software, hardware or other techniques by OEMs that prevent consumers from repairing their EV battery.
- **Design Criteria for Standardization of Core Components:** Requiring manufacturers to respect common standards for EV batteries allowing easy disassembly and replacement of key components could facilitate repairs.^{3,29}
- **Universal Access and Availability of Spare Parts:** Increasing the availability of EV battery spare parts facilitates repair for consumers and independent repair facilities. Replacement parts could be manufactured locally, reducing the fossil fuels emissions from cargo transportation and supporting a localized, circular economy.⁸

²⁸ Marshall, Aarian. 2023. "A Controversial Right-to-Repair Car Law Makes a Surprising U-Turn." Wired Magazine, August 23, 2023. <https://www.wired.com/story/nhtsa-massachusetts-right-to-repair-letter>.

²⁹ Kendall, Alissa, Kristi Dayemo, Nadiyah Helal, Galym Iskakov, Francisco Pares, Margaret Slattery, Lew Fulton. 2023. "Electric Vehicle Lithium-ion Batteries in Lower- and Middle-income Countries: Life Cycle Impacts and Issues." UC Davis: Institute of Transportation Studies. <https://escholarship.org/uc/item/7m2536mp#author>.

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