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November 14, 2023

Henry Liu
Director, Bureau of Competition
FEDERAL TRADE COMMISSION
600 Pennsylvania Avenue, NW
Washington, DC 20580

VIA ELECTRONIC MAIL AND U.S. POSTAL SERVICE

Re: Petition for Section 5 Rulemaking Addressing Consumers' Right to Repair

Dear Director Liu:

Pursuant to 15 U.S.C. § 57a and 16 C.F.R. § 1.9, we submit the attached Petition for Rulemaking on behalf of the U.S. Public Interest Research Group Education Fund and iFixit ("Petitioners"). This Petition for Rulemaking requests that the Commission initiate a rulemaking to protect consumers' right to repair products that they have purchased.

The Petition details the increasing problem of manufacturers imposing restrictions on consumers' ability to repair their own products or obtain repairs from independent repair servicers. Such restrictions impose enormous costs on consumers, exacerbate manufacturers' market power by weakening competition in the aftermarket for repair services, and dramatically worsen unnecessary electronic waste. Petitioners respectfully submit that a rulemaking under the Commission's Section 5 authority, 15 U.S.C. § 45, is necessary to provide uniform repairability standards, and to bring competition law in line with modern market realities.

We appreciate your prompt attention to this matter and are available to assist your office in any review of this petition.

Sincerely,

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BEFORE THE UNITED STATES FEDERAL TRADE COMMISSION

U.S. PUBLIC INTEREST RESEARCH GROUP EDUCATION FUND & IFIXIT,
Petitioners

PETITION FOR RULEMAKING TO PROTECT CONSUMERS' RIGHT TO REPAIR

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I. Introduction

The U.S. Public Interest Research Group Education Fund (“PIRG”) and iFixit, pursuant to 16 C.F.R. § 1.9 and 5 U.S.C. § 553(e), hereby petition the Federal Trade Commission (“FTC” or the “Commission”) to promulgate rules governing consumers’ right to repair products and devices.

Manufacturers are increasingly restricting the ability of consumers and independent shops to repair products. Manufacturers do so in a number of ways, including requiring the use of specialized tools, implementing software locks, and withholding repair information from the public. Using these tactics, manufacturers force consumers to use manufacturer-approved repair shops and manufacturer-approved parts. Manufacturers can also cease supporting older devices, forcing consumers to purchase new devices prematurely. These tactics harm consumers by driving up the price of repairs and shortening the lifespan of products they buy. Additionally, manufacturers are creating unnecessary e-waste, harming the environment in the pursuit of profit.

A rule protecting the right to repair might take a range of forms, from a prohibition of unfair and deceptive trade practices limiting repair activities, to a repairability labeling system that would enable consumers to make informed purchasing decisions. Petitioners submit several considerations that should inform the Commission in the drafting of such rules. But regardless of the final form they would take, such rules would provide a single nationwide standard, improve access and affordability for consumers of repair services, bolster independent repair businesses, and reduce e-waste.

II. Interest of the Petitioners

The U.S. Public Interest Research Group Education Fund (“PIRG”) is a federation of independent, state-based, citizen-funded Public Interest Research Groups. PIRG is an advocate for the public interest that speaks out for a healthier, safer world in which people are freer to pursue our own individual well-being and the common good.

iFixit is the free repair manual that anyone can edit. Founded in 2003 when nobody could find an iBook repair manual and iFixit decided to write its own, the iFixit repair community has grown to millions of users across the world. Together, iFixit has written nearly 100,000 repair guides in a dozen languages teaching people how to fix everything from iPhones to toasters to tractors.

III. Background

A. Description

Manufacturers are increasingly restricting the ability of consumers and independent shops to repair the products they buy and own. By employing tactics such as requiring the use of specialized tools, implementing software locks, and withholding repair information from the public, manufacturers increase their revenue by forcing consumers to continue using their business or that of their repair networks—or to give up and buy from them a new device. The consequences of these repair restrictions are that manufacturers hurt consumers financially, generate needless environmental waste, and consolidate their market power. This Petition therefore requests the Commission to take regulatory action to remediate these problematic effects by initiating rulemaking to regulate how companies are permitted to restrict repair.

i. FTC's Interest in Collecting Information on Repair Restrictions

The submission of this Petition comes on the heels of growing advocacy around curtailing repair restrictions, in which the Commission itself has shown substantial interest. In May 2021, the Federal Trade Commission submitted a comprehensive report, *Nixing the Fix: An FTC Report to Congress on Repair Restrictions* to the Committees on Appropriations of the House and Senate upon Congress' directive. This report was based on a workshop that the Commission held on July 16, 2019, during which it gathered public comments and research on issues that repair restrictions cause and exacerbate; it also built on years of investigations by repair advocates and arguments by manufacturers' relating to repairability. Congress' interest in the rise of repair restrictions, its effects, and "recommendations on how to best address these problems"¹ are indicative of the significant strain that repair restrictions have placed on consumers and independent businesses, as well as the growing public demand for expanded protections of the right to repair.

B. Growth of the Problem

Restrictions on the ability of consumers to repair their equipment and devices have grown substantially in recent years, due both to the increasing complexity of technology and the consolidation of most manufacturing industries. But such restrictions have a long history. For instance, the motor industry created one of the earliest restrictions on repair, with Ford creating a network of authorized repair shops in the 1910s and 1920s under the company's commitment to "prioritizing repairability."² The idea of throwaway products and mass consumption began to

¹ H.R. Rep No. 116-456 at 67 (2021).

² Daniel A. Hanley, Claire Kelloway, & Sandeep Vaheesan, *Fixing America: Breaking Manufacturers' Aftermarket Monopoly and Restoring Consumers' Right to Repair* at 6, Open Markets Institute (Apr. 2020), available at https://static1.squarespace.com/static/5e449c8c3ef68d752f3e70dc/t/5ea8a6d93b485d0feb9b5d6b/1588111098207/Report_RightToRepair_HanleyKellowayVaheesan-1.pdf.

take hold during that time, promoting the mentality of planned obsolescence, “codified” by advertiser Justus George Frederick, that goods should be bought “for up-to-dateness, efficiency, and style ... rather than simply for the last ounce of use.”³ Manufacturers thus began to realize the potential to inhibit competition and retain customers by requiring them to purchase again and again from the same brand, employing design changes that reduced consumers’ demand for the ability to repair.⁴ Recognizing the effect these corporate policies could have on purchasers, the U.S. Department of Justice took steps in the 1950s to curtail such restrictions. For example, in 1956, IBM and the U.S. Department of Justice entered into a consent decree that required IBM to allow consumers and independent repair shops to repair its mainframe computers by making “parts and subassemblies available for use.”⁵ But as the government’s interest in (and budget for) antitrust enforcement waned, repair restrictions multiplied.

With technological advancement came new ways that manufacturers could restrict consumers’ ability to repair their own devices or obtain repairs from someone other than the company that made the device. In particular, the software that became ubiquitous in everyday products—from “Barbie dolls to doorbells to automobiles”⁶—effectively multiplied the ways in which manufacturers could ensure their consumers’ dependency, because software necessary to access to complete repairs can be more easily “locked” or withheld from users than physical attributes of a device.⁷ As described more fully below, this development and several others—including consolidation in the original equipment market—has caused the repairability problem to grow drastically in recent decades.

³ *Id.* at 7.

⁴ *Id.*

⁵ Hanley et al., *supra* n.2, at 5.

⁶ *Id.*

⁷ *Id.* at 8.

i. Types of Repair Restrictions

As the Commission laid out in *Nixing the Fix*, there are several types of repair restrictions on consumer goods that have significantly curtailed repair rights.⁸ The variety of limitations mentioned below show how restrictions have morphed into a multi-faceted and pervasive issue, requiring a rule such as that proposed in this petition encompassing all of these practices and cutting across industries.

1. Product Designs

Product designs can make it physically difficult to repair consumer goods. For example, manufacturers may fix components with glue, or implement unique locks, screws, and tools that the manufacturers refuse to sell to consumers and independent shops, who are thus left unable to repair these devices. In particular, proprietary screws are licensed and difficult to find, and security screws are “usually designed to be difficult to remove without the corresponding (usually uncommon) bit.”⁹ For example, the pentalobe screw is the security screw that Apple chose to use for its products starting in 2009; it replaced the use of the Phillips screw, a common alternative with a widely available screwdriver, on the outside of the iPhone 4—even though “[m]echanically, the pentalobe tends to be inferior to other screws.”¹⁰ Indeed, Apple made the change to pentalobe screws *only* for the screws on the outside of its phones (screws on the inside were still Phillips screws), making clear that the purpose of the design change was to impede repair.¹¹

⁸ Federal Trade Commission, *Nixing the Fix: An FTC Report to Congress on Repair Restrictions* at 17 (May 2021) (hereinafter *Nixing the Fix*), available at https://www.ftc.gov/system/files/documents/reports/nixing-fix-ftc-report-congress-repair-restrictions/nixing_the_fix_report_final_5521_630pm-508_002.pdf.

⁹ Kay Kay Clapp, *Bit History: The Pentalobe*, iFixit (Apr. 21, 2018), available at <https://www.ifixit.com/News/9905/bit-history-the-pentalobe>.

¹⁰ *Id.*

¹¹ Kyle Wiens & Dr. Elizabeth Chamberlain, *Barriers to Repair: iFixit Evidence for the House Judiciary Right to Repair Hearing* at 24, iFixit (Jul. 14, 2023) (hereinafter “*Barriers to Repair*”), available at

Companies also use materials that would be destructive to open and repair. For example, separating the Samsung Galaxy S22 phone’s front and rear case is an arduous task that can permanently destroy the bezel around the case.¹² Soldering is also used in laptops, such as the Dell XPS 13, which has its RAM soldered onto its motherboard.¹³ Although soldered connections can sometimes be resoldered, soldered RAM is generally connected to the motherboard via a ball grid array technique that requires complex and expensive equipment to rework, including a microscope to see the tiny components, an infrared preheater to rework the solder, and a fume extractor to remove toxic gases released in the process; needless to say, nearly all individuals and most repair shops lack the expertise and equipment necessary to perform this sort of repair.¹⁴ Often, if a label says “no user serviceable parts inside,” it means that the manufacturer has soldered parts together and simple upgrades—which, for computers in particular, used to be quite easy and commonplace—become infeasible.¹⁵

2. Withholding Information, Instructions, and Manuals

Another tactic employed across industries is manufacturers withholding repair instructions and service manuals, claiming that making such information available would be giving away “trade secrets,” or would “lead users to hurt themselves.” However, such releases do not need to include proprietary information; it would simply be a way for consumers and independent technicians to have the service instructions manufacturers prefer their own

<https://judiciary.house.gov/sites/evo-subsites/republicans-judiciary.house.gov/files/evo-media-document/wiens-testimony.pdf>.

¹² Sam Goldheart, *Galaxy S22 Teardowns: Apple is Making Samsung Sweat*, iFixit (March 3, 2022), available at <https://www.ifixit.com/News/57567/galaxy-s22-teardowns-apple-is-making-samsung-sweat>.

¹³ Wiens & Chamberlain, *Barriers to Repair*, *supra* n.11, at 22.

¹⁴ Greg Davill, *DellXPS13 Ram Upgrade (7390)* (Nov. 20, 2021), available at <https://gregdavill.com/posts/dell-xps13-ram-upgrade/>

¹⁵ Wiens and Chamberlain, *Barriers to Repair*, *supra* n. 12 at 22.

technicians to use.¹⁶ Toshiba is an example of a manufacturer that vehemently polices access to its manuals: In 2012, Tim Hicks, who ran a site where he posted service instructions online for free, was forced by Toshiba’s lawyers to take down manuals for over 300 Toshiba laptops.¹⁷ At the beginning of the pandemic, Petitioner iFixit had similarly created a “Medical Device Repair Database” with information for keeping devices such as ventilators in good repair and was widely commended for helping to support caregivers by doing so;¹⁸ however, companies such as Steris attempted to have iFixit take the documentation down on “copyright grounds.”¹⁹

In the agricultural space, many repair parts are also electronically paired and require so-called “payload files” that can only be installed through dealer-level software.²⁰ This withholding of necessary information to complete repairs, combined with dealership consolidation nationwide, has resulted in dramatically reduced access to local farm equipment repair. A large portion of the country’s farmland has access to a single Deere dealership chain for repairs; across the country, there is just one John Deere dealership chain for every 12,018 farms and every 5.3 million acres of farmland.²¹ Yet because Deere withholds the “payload files” necessary for pairing new parts after a repair, farmers must travel long distances and endure long wait times to complete even routine repairs. Petitioner PIRG has concluded that this and other

¹⁶ Louis Rossmann, *Right to Repair Written testimony by Louis Rossmann of Rossmann Repair Group Inc.* at 7, available at https://www.pc.gov.au/_data/assets/pdf_file/0003/279381/subdr216-repair.pdf.

¹⁷ Kyle Wiens, *The Shady World of Repair Manuals: Copyrighting for Planned Obsolescence*, Wired (Nov. 12, 2012), available at <https://www.wired.com/2012/11/cease-and-desist-manuals-planned-obsolence/>.

¹⁸ See Molly Wood, *When ventilators break, iFixit can help*, Marketplace (May 21, 2020), available at <https://www.marketplace.org/shows/marketplace-tech/covid-19-ventilators-medical-equipment-repair-ifixit/>; Kit Walsh, *Medical Device Repair Again Threatened With Copyright Claims*, Electronic Frontier Foundation (June 11, 2020), available at <https://www.eff.org/deeplinks/2020/06/medical-device-repair-again-threatened-copyright-claims>.

¹⁹ *Id.*

²⁰ Kevin O’Reilly, *Service obstructor: John Deere software restricts farmer repair*, U.S. PIRG Education Fund (July 18, 2023), available at <https://pirg.org/edfund/resources/john-deere-repair-software/>.

²¹ Kevin O’Reilly, *Deere in the headlights II: How dealership consolidation reduces repair choice for farmers*, Public Interest Research Group (Feb. 23, 2022), available at <https://pirg.org/edfund/resources/deere-in-the-headlights-ii/>.

restraints on farmers’ ability to repair their own machinery costs farmers (and the broader economy) \$4.2 billion per year.²²

3. Remote Services and Updates

Telematics, which are most commonly used in automobiles, transmit the data of a product back to a remote computer controlled by the manufacturer.²³ Often the telematics system also gives manufacturers varying levels of control over the device—in some cases allowing them to “render hardware inoperable.”²⁴ VanMoof, an e-bike company, came under scrutiny because customers’ bikes would stop functioning if the business itself shut down, given that the bikes are controlled via smartphone and “depend on VanMoof’s servers to operate.”²⁵ Similarly, Apple and John Deere both use authentication, which relies on company servers, in order to make a new part operational, and which ties their products down to authorized repair channels.²⁶ This creates an unfair scenario for customers, who purportedly own the products they buy but depend on the whim of manufacturers for those products’ continued functionality.

Similarly, companies will manipulate software and firmware in various ways to make devices obsolete and to prevent consumers from doing repairs outside their authorized network. Original equipment manufacturers often employ software locking capabilities, rendering a device in need of even a minor repair inoperable until a manufacturer-licensed repair person can access the machine and diagnose the problem. For example, John Deere tractors have dozens or hundreds of sensors, each connected to a controller network; if any one of the controller

²² See generally *Out to Pasture: Repair Restrictions Lead to Tractor Downtime and High Costs; Right to Repair Would Help*, U.S. PIRG (Apr. 2023), available at <https://publicinterestnetwork.org/wp-content/uploads/2023/04/Out-to-Pasture-1.pdf>.

²³ Wiens & Chamberlain, *supra* n.11, at 20.

²⁴ *Id.*

²⁵ Gergely Orosz, *The Pulse: VanMoof files for bankruptcy protection*, The Pragmatic Engineer (Jul. 13, 2023), available at <https://newsletter.pragmaticengineer.com/p/the-pulse-vanmoof-files-for-bankruptcy>.

²⁶ Wiens & Chamberlain, *Barriers to Repair*, *supra* n.12, at 21.

networks encounters an error that relates to the machine’s safety or environmental system (which a high proportion of malfunctions do), the software system may cause the machine to go into “limp mode,” which disables most of the equipment’s functionality until a repair is authorized and the diagnostic error code is cleared.²⁷ Companies also cease software support within the lifespan of the product; Samsung, for instance, stops providing necessary software updates in as little as two years for household appliances that would otherwise last around 10-11 years, a practice that drastically shortens the useful life of these devices.²⁸

4. Endorsement of Original Parts and Disparagement of Competing Repair Options

Manufacturers also restrict independent repair by promoting their own parts and repair networks and unfairly disparaging third party parts and businesses.²⁹ This is a tactic widespread in the auto industry: As the Commission described in *Nixing the Fix*, auto manufacturers will often spread the word that aftermarket products and independent repairs are “dangerous for the driver.”³⁰ This also includes attempting to void warranties if a consumer chooses to use non-original parts or third-party repair services: The Auto Care Association’s comment to the Commission mentioned two surveys that found that in order to maintain their warranties, car dealers told 25% of buyers they were required to have their cars repaired at the dealership.³¹ Additionally, despite making moves towards self-service repair, Apple implemented its own scare tactics by flashing “unable to verify” warnings when installing parts that have not been

²⁷ Kevin O’Reilly, *Deere in the Headlights* at 5-6, U.S. PIRG Education Fund (Feb. 2021), *available at* perma.cc/42GB-TJ4B; *see also* U.S. PIRG, *Repair.org call on EPA to investigate Deere over Right to Repair*, PIRG (Jul. 21, 2022), *available at* <https://pirg.org/media-center/pirg-repairorg-call-epa-investigate-deere-over-right-repair/>.

²⁸ Barry Collins, *Smart Fridges Turn ‘Dumb’ In As Little As Two Years, Report Warns*, *Forbes* (Jun. 8, 2020), *available at* <https://www.forbes.com/sites/barrycollins/2020/06/08/smart-fridges-turn-dumb-in-as-little-as-two-years/?sh=6e8a929f2530>.

²⁹ *Nixing the Fix*, *supra* n.8 at 22.

³⁰ *Id.*

³¹ Hanley et al., *supra* n.2 at 10.

purchased through their own parts sales network, even original parts taken from new identical products,³² resulting in feature loss, limiting the potential for recycling, and discouraging third party repair. Companies also use software to pair device parts together: Xbox and PlayStation consoles have optical drives that are “married” to the consoles’ motherboards, so replacing only one of these parts means the device will not work.³³

5. End User Licensing Agreements

End User License Agreements (“EULAs”) are also a popular way of restricting repairs.³⁴ These agreements—also known as “click-wrap,” “shrink-wrap,” or “terms of service” agreements, depending on the industry—“grant corporations unprecedented access to monitor, manage, and restrict how consumers use their products, even going so far as to revoke ownership.”³⁵ For example, a few years ago John Deere updated its End User License Agreement such that it purported only to grant a farmer the limited right to use necessary software; obtaining a repair from a non-Deere-authorized repair technician risked violating the agreement and losing access to the necessary software.³⁶ Similarly, because PlayStation 3 users were running other operating systems on their consoles, Sony implemented a mandatory update that stopped users from doing so and used their agreement to justify the restriction.³⁷ The Barnes

³² Elizabeth Chamberlain, *Apple’s Self-Repair Vision Is Here, and It’s Got a Catch*, iFixit (Apr. 27, 2022), available at <https://www.ifixit.com/News/59239/apples-self-repair-vision-is-here-and-its-got-a-catch>.

³³ *Can You Replace A PS4 Motherboard?*, Old School Gamers, available at <https://osgamers.com/frequently-asked-questions/can-you-replace-a-ps4-motherboard>; Laybey Jockey, *Optical Drive*, Microsoft (Nov. 13, 2016), available at <https://answers.microsoft.com/en-us/xbox/forum/all/optical-drive/18705de6-5888-4a62-aa7e-09f5792b7dd8>.

³⁴ Hanley et al., *supra* n.2, at 14.

³⁵ *Id.*

³⁶ See FTC Complaint on behalf of Farmers Unions, U.S. PIRG, iFixit, and Other Advocacy Groups against John Deere (Mar. 3, 2022), available at https://drive.google.com/file/d/1h6HVLfQ491dyAhcdYM-w5v_FpVKmtOB3/view; see also Wiens & Chamberlain, *supra* n.11, at 13.

³⁷ Wiens & Chamberlain, *supra* n.11 at 13.

& Noble NOOK eReader terms of service similarly bar consumers from opening or servicing the device.³⁸

IV. Scope of the Problem

A. Cost to Consumers

Repair restrictions make repairs more costly for consumers and independent repair shops while increasing profits for manufacturers.³⁹ For instance, the International Association of Medical Equipment Remarketers and Services, Inc. found that manufacturer servicing ranges from \$500 to \$600 per hour, whereas independent services would be able to do the same for \$150 to \$250 per hour.⁴⁰

Manufacturers reap the benefit of restricting repairs in inflated profits. In the farm equipment sector, profit margins for repair can be up to five times higher than profit margins for selling equipment.⁴¹ Whereas car dealers normally get 28% of their profits from car sales, 48% of profits come from repairs.⁴²

These are all costs that are passed on to consumers: The cost of repairing just one electronic product is nearing half of the price of simply purchasing a new product.⁴³ In 2021, Petitioner PIRG found that American households spent around \$1,767 on new electronic products, \$287 more than in 2019, coming out to an alarming 19% increase in spending in two years.⁴⁴ Repairing products could reduce spending by 21.6%, approximately \$382 per year per household. Across 129 million households in the U.S., this would save households \$49.6 billion

³⁸ Kyle Wiens, *Copyright, the Internet of Things, and the End of Ownership*, iFixit (June 9, 2016), available at <https://www.ifixit.com/News/57567/galaxy-s22-teardowns-apple-is-making-samsung-sweat>.

³⁹ *Repair is Noble*, iFixit, available at <https://www.ifixit.com/Right-to-Repair>.

⁴⁰ *Nixing the Fix*, *supra* n.8, at 40.

⁴¹ Hanley et al., *supra* n.2 at 15.

⁴² *Id.*

⁴³ *Id.* at 16.

⁴⁴ *Repair saves families big* at 2, PIRG (2023), available at https://publicinterestnetwork.org/wp-content/uploads/2023/04/Repair-Saves-Families-Big_USPEF_APR23.docx-1.pdf.

per year.⁴⁵ Another study found that between 2007 and 2014, Americans spent \$3.4 billion on just repairing phone screens.⁴⁶

A 2021 survey conducted by Consumer Reports concluded that out of 55% of consumers who had a home appliance break down in the last five years, only 33% had the appliance repaired successfully and 26% tried to have it repaired but ended up getting a replacement instead, half of whom decided to do so only because repair was too expensive.⁴⁷ Similarly, the Open Markets Institute found that AirPods often start losing their charge within the first 18 months of use, and the difference between buying battery service replacements from Apple versus simply purchasing a new set of AirPods was less than \$20.⁴⁸ One individual submitted a comment to the FTC stating that despite paying \$250 for a new computer, the cost to replace/repair the motherboard was quoted to them at more than \$300.⁴⁹ The Commission itself has concluded that it received no comments, before or after the workshop it held on repair restrictions, that “rebutts the right to repair advocates’ argument that repair restrictions increase the price consumers pay for repairs.”⁵⁰

Many Americans are unable to afford these rising costs. The American Automobile Association found in 2017 that 33% of Americans are unable to pay for an unexpected repair to their car.⁵¹ Those who are most vulnerable are also generally those most affected by rising

⁴⁵ *Id.* at 4.

⁴⁶ Hanley et al., *supra* n.2, at 15.

⁴⁷ *Investigation of Barriers to Appliance Service Information Access* at 18-19, Right to Repair Coalition (Jan. 31, 2023) (hereinafter “*Barriers to Appliance Service Information*”), available at <https://valkyrie.cdn.ifixit.com/media/2023/01/30193712/Repair-Coalition-Letter-for-FTC-Energy-Guide-Ruling-ANPR-R611004.pdf>.

⁴⁸ *Restoring an Open Marketplace for Product Repairs* at 5, Open Markets Institute, available at <https://static1.squarespace.com/static/5e449c8c3ef68d752f3e70dc/t/5ebf65605ff836783df1e30f/1589601636087/O MI-Comment-Restoring-an-Open-Marketplace-for-Product-Repairs.pdf>.

⁴⁹ Gi Gi, *Comment Submission for Nixing the Fix Call for Empirical Research*, Regulations.gov (Aug. 19, 2019), available at <https://www.regulations.gov/comment/FTC-2019-0013-0054>.

⁵⁰ *Nixing the Fix*, *supra* n.8, at 40.

⁵¹ Hanley et al., *supra* n.2, at 15.

costs—for example, of Americans with an annual family income of \$40,000 or less, only 48% would be able to cover an emergency expense of \$400.⁵² Those who make less than \$30,000 per year are 14% more likely to say that mobile device repairability is very important to them than those who make \$100,000 per year.⁵³ Racial disparities are also vast: 53% of Black Americans rate smartphone or tablet repairability as very important to them compared with about a third of white Americans, and the gap is even wider among those who make less than \$30,000 per year.⁵⁴ For those who depend on smartphones for internet access, repair issues are even more vital. More Black American households than white or Hispanic households depend on smartphones for internet access.⁵⁵ Additionally, households that make less than \$30,000 per year are over two and half times more likely than those making over \$100,000 per year to use smartphones as their only internet access at home.⁵⁶

B. Impact on Small Businesses

American small businesses operate on tight margins and with limited room for error. In order to compete, they increasingly must use the latest technology to meet consumer demand and reduce costs. This includes everything from modern payment consoles to appliances to robotic devices for inventory management. Struggling hospitals in rural areas, for instance, are unable to meet their needs for patient care when they cannot repair their equipment. As a medical worker told *The Guardian*, “Waiting for a manufacturer to show up means you often have to delay a case

⁵² *Nixing the Fix*, *supra* n.8, at 40 & fn.223.

⁵³ Kaveh Waddell, *People Want to Get Phones and Appliances Fixed—But Often, They Can’t*, Consumer Reports (Feb. 28, 2022), <https://www.consumerreports.org/consumer-rights/people-want-to-get-phones-appliances-fixed-but-often-cant-a1117945195/>.

⁵⁴ *Id.*

⁵⁵ *Id.*

⁵⁶ *Id.*

from going to the operating room, or in some cases even cancel it.”⁵⁷ When local technicians are unavailable, repair of life-saving equipment can even take “more than five days”—lifting repair restrictions on the other hand would save such hospitals “hundreds of thousands of dollars” and prevent critical care from being compromised and delayed.⁵⁸

By definition, small business owners bring an entrepreneurial spirit and do-it-yourself attitude to the workplace. This includes a desire to repair products they own to control costs and ensure that any malfunctioning products are quickly back in service. A family farmer from Maine, Jim Gerritsen, testified in front of the U.S. House of Representatives Subcommittee on Underserved, Agricultural, and Rural Business Development to this point.⁵⁹ As a direct seller of organic crops to retail customers for more than 40 years, he and his family do not purchase modern farm tractors and equipment with computer chips; they prefer to use instead tractors from the 1970s and earlier so that they can repair their machinery themselves. This way, they are not subject to their equipment going into “limp mode” during crucial business times such as peak planting or harvest.⁶⁰ Many in the farming business feel similarly: “Of 74 farmers across 14 states surveyed by U.S. PIRG Education Fund and National Farmers Union, 77% indicated that they had bought older-model equipment to avoid the software in newer equipment.”⁶¹

⁵⁷ Kari Paul, *Why right to repair matters – according to a farmer, a medical worker, a computer store owner*, The Guardian (Aug. 2, 2021), available at <https://www.theguardian.com/technology/2021/aug/02/why-right-to-repair-matters-according-to-a-farmer-a-medical-worker-a-computer-store-owner>.

⁵⁸ *Id.*

⁵⁹ Testimony of Jim Gerritsen from the U.S. House of Representatives Subcommittee on Underserved, Agricultural, and Rural Business Development Hearing on “Right to Repair and What it Means for Entrepreneurs,” (Sep. 14, 2022), available at <https://docs.house.gov/meetings/SM/SM21/20220914/115093/HHRG-117-SM21-Wstate-GerritsenJ-20220914.pdf>.

⁶⁰ *Id.*

⁶¹ *Id.* (citing Kevin O’Reilly, *Deere in the Headlights*, PIRG (Feb. 5, 2021), available at <https://pirg.org/resources/deere-in-the-headlights-3/>).

C. Environmental Impact

Repair restrictions contribute significantly to rising amounts of e-waste and other environmental hazards. Electronic waste can be toxic to human health if not disposed of properly. Manufacturers like to claim that the amount of e-waste they produce has decreased. E-waste is measured by weight, and modern electronics are lighter than their older counterparts. For example, one study found that the cumulative weight of TVs sold in Sweden was lower in 2014 than it was in 1996, despite an exponential increase in the number of TVs sold.⁶² The average weight of a flatscreen LCD TV is only half that of an equivalently-sized CRT TV.⁶³

Although manufacturers like to claim that if devices are repaired “properly” then the lives of such devices are extended, rising manufacturer monopolies on repair have not resulted in concomitant decline in e-waste volume. For instance, a UN report found that in 2014, the amount of e-waste generated worldwide was 44.4 million metric tons (Mt); in 2019, this increased to 53.6 Mt; and by 2030, the report’s projection shows a near doubling of this amount in only 16 years.⁶⁴ The report states that “short life cycles” of devices and “few repair options” are leading catalysts of these alarming e-waste growth rates.⁶⁵ In the United States, “the average family generates 176 pounds” of e-waste annually and the country generates approximately 6.9 million tons.⁶⁶ Every day, Americans discard 416,00 cellphones alone.⁶⁷ Meanwhile, the fastest

⁶² Yuliya Kalmykova, et al., *Out with the Old, Out with the New—The Effect of Transitions in TVs and Monitors Technology on Consumption and WEEE Generation in Sweden 1996-2014*, 46 WASTE MGMT. 511 (2015), available at <https://www.sciencedirect.com/science/article/pii/S0956053X1530101X>.

⁶³ *Id.*

⁶⁴ *Id.* at 42 & fn.233.

⁶⁵ *Id.* (quoting Vanessa Forti et al., *The Global E-Waste Monitor 2020*, available at https://ewastemonitor.info/wp-content/uploads/2020/11/GEM_2020_def_july1_low.pdf).

⁶⁶ Alex De Bellis and Nathan Proctor, *Repair Saves Family Big*, U.S. PIRG (Jan. 2021), available at <https://uspirg.org/feature/usp/repair-saves-families-big>.

⁶⁷ Hanley et al., *supra* n.2, at 17.

growing waste stream in landfills is e-waste.⁶⁸ Even when recycled, 30% of materials are lost and cannot be reused.⁶⁹

Like phones, household appliance manufacture has a significant environmental impact. To make a single household appliance, 15-100 times more resources than the final mass of the product are needed.⁷⁰ Between a quarter and half of greenhouse gasses released during the household appliance's lifespan goes toward extracting and processing these resources.⁷¹

By making repairs more affordable and available, products' lifespans can be extended for more devices and reduce the amount waste being generated on such a large scale. Making repairs more accessible also allows for the reusing and recycling of parts, further reducing the negative environmental impact repair restrictions currently fuel.⁷² Studies have found that extending the lifespan of smartphones and other electronics in the EU by just one year would reduce carbon emissions equivalent to taking two million cars off the road annually⁷³; that keeping a smartphone for five years instead of three reduces greenhouse gas emissions by 31%⁷⁴; and that extending the lifespan of a washing machine by 6 years would reduce its overall environmental impact by 46%.⁷⁵

⁶⁸ *Id.*

⁶⁹ *E-waste is the Toxic Legacy of our Digital Age*, iFixit, available at <https://www.ifixit.com/Right-to-Repair/E-waste>.

⁷⁰ *Barriers to Appliance Service Information*, *supra* n.47, at 13.

⁷¹ *Id.*

⁷² Jack Monahan, *International E-Waste Day Reminds Us Devices Need to Last Longer*, iFixit (Oct. 18, 2022), available at <https://www.ifixit.com/News/67115/international-e-waste-day-reminds-us-devices-need-to-last-longer>.

⁷³ *Revealed: The Climate Cost of 'Disposable Smartphones'*, European Environmental Bureau (Sept. 18, 2019), available at <https://eeb.org/revealed-the-climate-cost-of-disposable-smartphones/>.

⁷⁴ David Sanchez et al., *Life Cycle Assessment of the Fairphone 4*, at 13 (March 2022), available at <https://www.fairphone.com/wp-content/uploads/2022/07/Fairphone-4-Life-Cycle-Assessment-22.pdf>.

⁷⁵ Paolo Tecchio et al., *Analysis of Durability, Reusability and Reparability—Application to Washing Machines and Dishwashers* (Dec. 1, 2016), available at <https://publications.jrc.ec.europa.eu/repository/handle/JRC102632>.

D. Impact on Independent Repair Shops

Repair restrictions also have a significant impact on independent repair shops and their employees. Repair restrictions impede these small business owners from fairly competing with manufacturers and their authorized repair networks.⁷⁶ Finding specific parts can prove near impossible.⁷⁷ For instance, a PIRG survey found that 80% of biomedical technicians have equipment that cannot be serviced due to repair restrictions, such as service keys and problems accessing parts and service materials.⁷⁸

Manufacturers' marketing techniques and planned obsolescence also create a barrier for business: Despite somewhat better availability now for phone parts than in previous years, for instance, phone repair businesses find their income dropping because of "ever-more tempting deals to customers to trade-in their old products for shiny new ones."⁷⁹ Additionally, manufacturers label independent repair shops as not to be trusted, despite repair technicians going through similar training and certification as manufacturers' technicians.⁸⁰ Independent repair shops are often staffed by former employees of big manufacturers, further diluting manufacturers' claims that these workers are unqualified to repair the same devices.⁸¹ Moreover, many repairs do not even need technician-related experience and could be performed by users absent repair restrictions: The Operations Manager of a repair shop in North Carolina confirmed that his staff would often remark about teenagers who often walk into his shop with sufficient technical knowledge such that "that kid could do our job."⁸²

⁷⁶ *Nixing the Fix*, *supra* n.8, at 43.

⁷⁷ Chloe Veltman, *Fixit culture is on the rise, but repair legislation faces resistance*, NPR (May 27, 2023), available at <https://www.npr.org/2023/05/27/1178512938/fixit-culture-is-on-the-rise-but-repair-legislation-faces-resistance>.

⁷⁸ *Hospital technicians renew urgent call for Right to Repair medical equipment*, PIRG (Feb. 10, 2021), available at <https://pirg.org/articles/hospital-technicians-renew-urgent-call-for-right-to-repair-medical-equipment/>.

⁷⁹ *Id.*

⁸⁰ Wiens & Chamberlain, *supra* n.11, at 14.

⁸¹ *Id.*

⁸² *Id.*

Nor have manufacturer-licensed repair options provided an adequate substitute for many independent repairers. Becoming part of an authorized repair network may not be a beneficial opportunity for many repair shops. In 2016, when Apple began to allow repair shops to work on iPhones, these shops had to pay Apple a fee to become “authorized.”⁸³ However, this status only allowed them to do a few select repairs, while shipping the phone to Apple if a customer comes in with an issue outside of that designated list. One independent shop owner explained that becoming Apple-certified would mean losing “75% of my opportunities to do repairs on things and would have to send that business to Apple for a small finder’s fee.”⁸⁴

Manufacturers also deprive rural communities of access to repair services. Some communities may not have authorized repair shops or technicians within a reasonable distance. A farmer may suffer because their tractor breaks down and they cannot afford the lost days (especially during planting or harvesting season) to have their equipment repaired by a manufacturer-authorized dealership.⁸⁵ One repair shop owner from New Hampshire testified that the nearest Apple-authorized repair shop is 45 minutes from his location, the nearest Samsung and Google devices facility is 90 minutes away, and for many devices from other companies, the only option for consumers in his area is to mail in the product.⁸⁶

E. Monopolization

Repair restrictions also consolidate the market for repair services and parts, diminishing competition and allowing manufacturers to drive up consumer prices. Manufacturers often make some version of a “benevolent monopoly” argument to justify their control, by saying, for

⁸³ Jason Koebler, *Do You Know Anything About Apple’s ‘Authorized Service Provider’ Program?* VICE (Mar. 16, 2017), available at <https://www.vice.com/en/article/yphqwx/do-you-know-anything-about-apples-authorized-service-provider-program>.

⁸⁴ *Id.*

⁸⁵ Hanley et al., *supra* n.2, at 16.

⁸⁶ Testimony of Brian Clark from the House Small Business Subcommittee Hearing on “Right to Repair Laws (Sep. 14, 2022), available at <https://www.c-span.org/video/?522857-1/hearing-on-repair-laws>.

example, “Home appliance manufacturers take monumental strides to ensure their customers are satisfied not only at the time of purchase, but throughout the life [of] the product.”⁸⁷ This allows manufacturers to tout their brand and commitment to repairability while at the same time maintaining a tight grip on that aftermarket.⁸⁸

Limiting the availability of repair information, parts, and software only to those with exclusive dealing contracts not only makes repairs unnecessarily difficult and costly—it also can extend manufacturers’ market power in the original equipment market to the aftermarket for repair, which the Supreme Court recognized over 30 years ago can be a separate product market.⁸⁹ Manufacturer dominance of this separate market can be lucrative—10% to 40% of revenue for industrial companies come from repair and aftermarket sales⁹⁰—but it can also exacerbate the problems discussed earlier in this memo. For example, with control of the repair aftermarket, manufacturers can push consumers to replace products in a shorter timeframe by hiking up repair prices so that consumers pay just as much for repairs as they would to simply buy a new product.⁹¹ Independent repair professionals innovate to get around repair restrictions, such as Petitioner iFixit’s development of a pentalobe-shaped screwdriver⁹² or a German repair shop that developed a tool for fixing a malfunctioning MacBook lid angle sensor without needing to go through Apple.⁹³ Still, repair markets have tended toward consolidation, leaving repair professionals playing a never-ending game of repair restriction whack-a-mole. As a result,

⁸⁷ Nathan Proctor, *Here’s how manufacturers argue against repair*, PIRG (Jul. 1, 2019), available at <https://pirg.org/articles/heres-how-manufacturers-argue-against-repair/>.

⁸⁸ *Id.*

⁸⁹ See generally *Eastman Kodak Co. v. Image Technical Services, Inc.*, 504 U.S. 451 (1992).

⁹⁰ Hanley et al., *supra* n.2, at 3.

⁹¹ *Id.* at 16.

⁹² Clapp, *supra* n.9.

⁹³ Janhoi McGregor, ‘Genius’ New MacBook Repair Tool Has Defeated Apple’s Hardware Lock, *Forbes* (Oct. 11, 2023), available at <https://www.forbes.com/sites/jaymcgregor/2023/10/11/genius-new-macbook-repair-tool-has-defeated-apples-hardware-lock/?sh=b0e52cd6f3f9>.

greater market concentration stifles innovation, reduces consumer independence, and increases harmful environmental impacts and waste.⁹⁴

V. Why a Rule Is Needed Under Section to Protect the Right to Repair

A. Efforts to Date to Address Repair Restrictions Under Existing Law Have Failed to Remedy the Problem

Although the Biden Administration, the Commission, and private litigants have in recent years ramped up scrutiny on manufacturers and spotlighted issues related to repair restrictions, these actions have not curtailed the vast scale of problematic conduct and consumer harm described above. This is in part due to a lack of receptiveness from courts to treat repair restrictions as violating the Sherman Act, as well as the lack of clear guidance focused specifically on repair restrictions that would enable manufacturers, consumers, and independent repair shops to understand what types of restrictions are unlawful. Moreover, the exponential growth of technological advances and the evolving market this growth has created have resulted in new modes of restriction that enforcement bodies and slow-moving developments in antitrust case law have struggled to keep up with.

Courts have been struggling with how to assess repair restrictions under federal antitrust law for at least 30 years, with mixed results. The Supreme Court's landmark decision in *Eastman Kodak Co. vs. Image Technical Services* was an important Sherman Act case addressing the right to repair, which ostensibly allowed consumers to bring suit against companies for restricting aftermarket replacement parts for purchased products.⁹⁵ The Court held that, under certain conditions, companies with sufficient market power in a secondary market can be held liable for Sherman Act violations, even if they did not have significant market power in the

⁹⁴ Hanley et al., *supra* n.2, at 25.

⁹⁵ 504 U.S. 451 (1992).

original equipment market.⁹⁶ Yet many courts have limited this decision to apply only when a manufacturer changes its policy regarding aftermarket parts after a consumer has already bought the product.⁹⁷ This interpretation is unhelpful for the plethora of consumers who buy products that come with aftermarket restrictions imposed at the point of sale,⁹⁸ and it does not comport with *Kodak*'s rationale, as the U.S. Department of Justice's Antitrust Division recently recognized in a Statement of Interest it filed in the ongoing case involving John Deere's repair restrictions.⁹⁹ Courts have also limited *Kodak* by not imposing liability when aftermarket products are protected by intellectual property rights; when aftermarket prices are considered to be product improvements; and when high switching costs are not proven to the court's satisfaction.¹⁰⁰

Petitioners agree with the U.S. Department of Justice that courts have improperly limited *Kodak*, and they also believe that current antitrust law could provide a meaningful limitation on manufacturers' ability to restrict repairs. But as courts' unwillingness to apply *Kodak* to its fullest extent makes clear, antitrust doctrine as currently applied in the federal courts has proven insufficient to address the scope of the problem described in this Petition. Thus, a rule passed under Section 5 would empower the Commission to better respond to ever-changing market conditions, that may or may not line up exactly with current antitrust precedents.

⁹⁶ *Nixing the Fix*, *supra* n.8, at 13.

⁹⁷ *Id.* (citing *Alcatel USA, Inc. v. DGI Technologies*, 166 F.3d 772 (5th Cir. 1999)).

⁹⁸ *Id.*

⁹⁹ Statement of Interest of the United States, *In re: Deere & Company Repair Services Antitrust Litig.*, No. 22-cv-50188, ECF 120 (N.D. Ill. Feb. 14, 2023), available at <https://www.justice.gov/media/1274486/dl?inline>.

¹⁰⁰ *Id.* at 20-21 (citing *SMS Sys. Servs. v. Digital Equip.*, 188 F.3d 11 (1st Cir. 1999)) *see also In re Indep. Serv. Org. Antitrust Litig.*, 203 F.3d 1322 (Fed. Cir. 2000); *Queen City Pizza, Inc. v. Domino's Pizza, Inc.*, 124 F.3d 430, 433 (3d Cir. 1997); *Brokerage Concepts, Inc. v. U.S. Healthcare, Inc.*, 140 F.3d 494 (3d Cir. 1988); Michael A. Carrier, *How the Federal Trade Commission Can Use Section 5 to Strengthen the Right to Repair*, 37 Berkeley Tech. L.J. 1145, 1170 (2022), <https://btlj.org/wp-content/uploads/2023/06/0006-37-3-Carrier.pdf> ("the inertia, compounding effect, and lack of self-reflection in the caselaw have erected significant hurdles in front of plaintiffs").

Similarly, the Magnuson-Moss Warranty Act (“MMWA”), 15 U.S.C. §§ 2301-2312, is an important tool protecting consumers’ right to repair the products they own, but in practice it has fallen short. The MMWA enables the Commission to promulgate rules that prohibit the tying of warranty coverage for a product to an agreement by the consumer to use only the manufacturer’s own repair services.¹⁰¹ There are certain exceptions to the statute, including when specific parts are needed for a device to properly function and the waiver of this law would be in the public interest, or when customers are not charged for service.¹⁰² As the Commission noted in *Nixing the Fix*, “technological developments have introduced new challenges that warrant a reconsideration of whether the [MMWA’s] anti-tying provision has kept pace with the evolving consumer goods repair market.”¹⁰³ Additionally, even though the MMWA can protect consumers’ right to repair their products at independent repair shops or with third-party parts, manufacturers can now evade the MMWA by restricting repair rights through means other than a warranty, as described above. *See supra* Section III.B.i.

In addition to the 2019 FTC workshop and the *Nixing the Fix* report, the Commission recently filed three administrative actions—against Weber-Stephen Products LLC, Harley-Davidson Motor Company Group, LLC, and MWE Investments, LLC—alleging violations of the MMWA and the Federal Trade Commission Act by including warranty provisions for their products that rendered their products’ warranties void if third-party parts or independent repairers were used to fix their consumer goods.¹⁰⁴ It also sent out warning letters to six major companies in 2018 for potential violations of the MMWA, stating that failure to correct their warranty

¹⁰¹ Hanley et al., *supra* n.2, at 20.

¹⁰² *Id.* at 20-21.

¹⁰³ *Nixing the Fix*, *supra* n.8, at 6.

¹⁰⁴ Lesley Fair, *FTC announces three right-to-repair cases: Do your warranties comply with the law?*, Federal Trade Commission (Jul. 7, 2022), available at <https://www.ftc.gov/business-guidance/blog/2022/07/ftc-announces-three-right-repair-cases-do-your-warranties-comply-law>.

statement practices would lead to law enforcement action.¹⁰⁵ But these enforcement actions, while laudable, have thus far been insufficient; Petitioner PIRG found over a year after the warning letters that 45 of 50 appliance manufacturers continued to maintain policies similar to those that were the subject of these enforcement actions.¹⁰⁶ Moreover, the statute also only applies to “consumer products,” which the Commission has described as “tangible property normally used for personal, family, or household purposes.”¹⁰⁷ This means that the MMWA does not cover a host of products used for commercial purposes that have long been encumbered by manufacturer-imposed repair restrictions, such as agricultural equipment.¹⁰⁸

Fortunately, there have been promising new developments in the Biden Administration, with the Commission taking a key leadership role in combatting repair restrictions. On July 9, 2021, President Joe Biden issued an Executive Order focused entitled “Promoting Competition in the American Economy.”¹⁰⁹ The Order encouraged the Commission and other agencies to consider using their authorities to address “unfair anticompetitive restrictions on third-party repair or self-repair of items, such as the restrictions imposed by powerful manufacturers that prevent farmers from repairing their own equipment.”¹¹⁰ Later that month, the Commission voted unanimously to “ramp up law enforcement against repair restrictions” and released a

¹⁰⁵ *FTC Staff Warns Companies that It Is Illegal to Condition Warranty Coverage on the Use of Specified Parts or Services*, Federal Trade Commission (Apr. 10, 2018), available at <https://www.ftc.gov/news-events/news/press-releases/2018/04/ftc-staff-warns-companies-it-illegal-condition-warranty-coverage-use-specified-parts-or-services>.

¹⁰⁶ Nathan Proctor, *Here’s how manufacturers argue against repair*, PIRG (Jul. 1, 2019), available at <https://pirg.org/articles/heres-how-manufacturers-argue-against-repair/>.

¹⁰⁷ FTC, *Business Person’s Guide to Federal Warranty Law* (Dec. 2006), available at <https://www.ftc.gov/business-guidance/resources/businesspersons-guide-federal-warranty-law>.

¹⁰⁸ See, e.g., Richard Stuhlbarg and Adele Karoum, *Is That Tractor Really a Lemon? A Look at State Legislation*, AgInnovator (2019) (“Most farm machinery and implements are used in the business or occupation of farming, rather than for personal use or household gardening, so they are not covered by the federal Magnuson-Moss Warranty Act.”), available at <https://www.farmequip.org/agi/2019-summer/is-that-tractor-really-a-lemon/>.

¹⁰⁹ Exec. Order 14,036, 86 Fed. Reg. 36987 (July 9, 2021).

¹¹⁰ *Id.*, § 5(h)(ii), 86 Fed. Reg. at 36993.

policy statement, on targeting “repair restrictions that violate antitrust laws enforced by the FTC or the FTC Act’s prohibitions on unfair or deceptive acts or practices.”¹¹¹

Moreover, the Commission in October 2022 sought public comments specific to possible amendments to the FTC’s Energy Labeling Rule and whether “the [C]ommission should require manufacturers to include information on how consumers can repair their products.”¹¹² By providing access to service bulletins and board updates, technicians would be able to be in the know about recalls, “help align parts to required tolerances,” and conduct repairs in a more comprehensive fashion.¹¹³ Although a step in the right direction, repair experts believe that simply providing manuals is not sufficient because modern appliances require software and equipment access.¹¹⁴

The Commission’s actions and renewed interest in recent years demonstrate its increasing resolve to crack down on companies’ limitations to repair rights. And while the enforcement actions and policy statements the Commission has issued recently are important developments, Petitioners respectfully submit that there still exists a need for a regulation specifically directed at this issue of national importance.

B. A Federal Rule Targeted at Repair Restrictions Would Improve the Foundation Laid by the States

A federal rule would not only enhance protections and enforcement overall—it would also provide predictability to both manufacturers and consumers. States have increasingly been

¹¹¹ *FTC to Ramp Up Law Enforcement Against Illegal Repair Restrictions*, Federal Trade Commission (Jul. 21, 2021), available at <https://www.ftc.gov/news-events/news/press-releases/2021/07/ftc-ramp-law-enforcement-against-illegal-repair-restrictions>.

¹¹² *Federal Trade Commission Seeks Public Comment on Initiative to Reduce Energy Costs and Strengthen Right-to-Repair*, Federal Trade Commission (Oct. 17, 2022), available at <https://www.ftc.gov/news-events/news/press-releases/2022/10/federal-trade-commission-seeks-public-comment-initiative-reduce-energy-costs-strengthen-right-repair>.

¹¹³ *Id.*

¹¹⁴ Elizabeth Chamberlain, *Repairing a Fridge Costs More Than a Fridge*, iFixit (Nov. 23, 2022), available at <https://www.ifixit.com/News/69391/repairing-a-fridge-costs-more-than-a-fridge>.

focused on the right-to-repair issue, and a number have passed their own laws. Those laws, however, often contain exclusions and holes that mean the goals of right-to-repair legislation are not fully addressed.. An FTC rule would significantly ameliorate these concerns, improve protections for repair, and provide clarity for consumers and manufacturers.

i. State Experiences with Right-to-Repair Laws

Some states have separately made advances in the right to repair movement, with multiple states passing laws regulating the right to repair. Earlier this year, Minnesota passed a wide-ranging right-to-repair law requiring that electronics manufacturers provide all Minnesotans with the same parts, tools, and documentation that they make available to their own repair providers. The law does contain some exceptions for farm equipment, video game consoles, motor vehicles, medical devices, and some specialized cybersecurity tools. Of course, while the law is intended to benefit Minnesotans, independent repair shops and individuals outside Minnesota will be able to access the same information. The law goes into effect in 2024.

New York's 2022 state law, on the other hand, while at first appearing promising ultimately fell victim to wide loopholes that undermine its effectiveness.¹¹⁵ Last minute amendments allow original equipment manufacturers to sell assemblies of parts rather than individual components if they choose to.¹¹⁶ The law also does not require original equipment manufacturers to provide passwords, security codes, or materials to bypass security features.¹¹⁷ These bypasses are sometimes required to repair a locked but otherwise operational device.¹¹⁸

¹¹⁵ *Governor Hochul Signs the Digital Fair Repair Act Into Law*, NY.Gov (Dec. 29, 2022), available at <https://www.governor.ny.gov/news/governor-hochul-signs-digital-fair-repair-act-law>.

¹¹⁶ <https://www.theverge.com/2022/12/29/23530733/right-to-repair-law-new-york-tech-hochul-oems-parts>; Kyle Wiggers, *New York's right-to-repair bill has major carve-outs for manufacturers*, TechCrunch (Jan. 3, 2023), available at <https://techcrunch.com/2023/01/03/new-yorks-right-to-repair-bill-has-major-carve-outs-for-manufacturers/>.

¹¹⁷ *Id.*

¹¹⁸ *Id.*

Certain industries are exempt from the law, including home appliances, motor vehicles, medical devices, and off-road equipment.¹¹⁹ The law also excludes enterprise electronics relied on by schools, hospitals, and data centers, as well as products consumers already own.¹²⁰

Other states have made progress on the right to repair as well. Colorado recently signed into law a bill that allows for information, parts, and tools to be available for agricultural equipment,¹²¹ as well as for powered wheelchairs.¹²² In 2020, 75% of Massachusetts voters voted in favor of requiring car manufacturers to allow owners and independent repair shops to access diagnostic and repair information, for which the National Highway Traffic Safety Administration has only just recently given a green light.¹²³

But Legislative progress has faced significant hurdles. Companies have pushed back hard against right to repair efforts, with “manufacturers [managing to] stop over 100 bills in over 40 states,”¹²⁴ and leading to bills such as the one signed into law in New York that initially protected consumer rights and independent businesses with much more strength than the end result.¹²⁵ This encouraging but limited progress further indicates the need for the Commission to take into serious consideration the need for a national approach to curtailing repair restrictions.

¹¹⁹ *Id.*

¹²⁰ Kyle Wiens, *New York Passes Historic Right to Repair Bill*, iFixit (Dec. 29, 2022), available at https://www.ifixit.com/News/70515/new-york-passes-historic-right-to-repair-bill?vgo_ee=3bheJeT%2FPRsWKKl8dfWh0vIMy%2BOWWuyaZunZiCXh6gI%3D.

¹²¹ *HB23-1011 Consumer Right To Repair Agricultural Equipment*, Colorado General Assembly, available at <https://leg.colorado.gov/bills/hb23-1011>.

¹²² *HB22-1031 Consumer Right To Repair Powered Wheelchairs*, Colorado General Assembly, available at <https://leg.colorado.gov/bills/hb22-1031>.

¹²³ *Feds say Mass. 'Right to Repair' law can go ahead with changes*, WBUR (Aug. 23, 2023), available at <https://www.wbur.org/news/2023/08/23/right-to-repair-car-data-massachusetts>.

¹²⁴ Nicholas De Leon, *New York Right-to-Repair Law Promises Easier, Cheaper Electronics Repairs*, Consumer Reports (Jan. 6, 2023), available at <https://www.consumerreports.org/right-to-repair/new-york-right-to-repair-law-electronics-a1202339752/#:~:text=The%20law%2C%20which%20had%20been,to%20do%20in%20the%20past.>

¹²⁵ See Rebekah F. Ward, *A bill for the 'right to repair' your devices shrank under influence of lobbyists*, Times Union (Oct. 22, 2022), available at <https://www.timesunion.com/news/article/Right-to-repair-tech-lobby-influence-17241026.php>.

As states move forward with legislation to protect consumers' repair rights, gaps remain that could undermine access to repair. A federal rule would complement state action, address gaps, and provide consistency across the country—benefiting both consumers and manufacturers.

ii. EU Rules

The European Commission has recently passed proposed right to repair rules as part of the European Green Deal.¹²⁶ The rules are intended to result in savings for consumers, increase demand for the repair sector, promote sustainable business models, and incentivize repairs over replacement.¹²⁷

The proposal contains multiple interrelated rules. On the supply side, the Ecodesign for Sustainable Products Regulation proposal requires certain standards for repairability, regulating product design and the availability of spare parts.¹²⁸ On the demand side, the Directive on Empowering Consumers for the Green Transition seeks to better inform consumers of the durability and repairability of goods so they can make informed purchases.¹²⁹ Additionally, the rules require that users of connected products have access to data they generate through their use of the product and have the right to give that data to third parties, including independent repairers.

¹²⁶ *The European Green Deal*, European Commission (last visited Nov. 1, 2023), https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en.

¹²⁷ *Proposal for a Directive of the European Parliament and of the Council on Common Rules Promoting the Repair of Goods and Amending Regulation (EU) 2017/2394, Directives (EU) 2019/771 and (EU) 2020/1828*, European Commission (March 22, 2023), available at <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52023PC0155>.

¹²⁸ *Proposal for a Regulation of the European Parliament and of the Council Establishing a Framework for Setting Ecodesign Requirements for Sustainable Products and Repealing Directive 2009/125/EC*, European Commission (March 30, 2022), available at <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2022%3A0142%3AFIN>.

¹²⁹ *Proposal for a Directive of the European Parliament and of the Council Amending Directives 2005/29/EC and 2011/83/EU as Regards Empowering Consumers for the Green Transition Through Better Protection against Unfair Practices and Better Information*, European Commission (March 30, 2022), available at <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52022PC0143&qid=1649327162410>.

The right to repair rules require that within the warranty period, sellers must offer repair services except when repair is more expensive than replacement. Outside the warranty period, consumers must have access to repair options for all devices considered “repairable” under the law. Sellers must inform consumers of these options, and the Commission has established an online repair platform to connect consumers with repair services and sellers of refurbished devices. Repair professionals, whether or not they are associated with a manufacturer, are required upon consumer request to submit a “European Repair Information Form” that aims to harmonize repair quotes.

The European Right to Repair coalition has described these reforms as “some steps in the right direction.”¹³⁰ However, they point out that the harmonized quote system will not address the problem of repair pricing, since it includes no controls for spare part prices; nor does the proposal stop anti-repair practices such as parts pairing.¹³¹ Further, the proposal only addresses products covered by ecodesign rules, which currently is a “very limited set of products” including washing machines, dryers, vacuum cleaners, and dishwashers—although soon rules will also cover smartphones and tablets.¹³² Campaigners also point to the danger of tying repair protections to a legal guarantee period, which “only deals with faults that can in some way be considered as a manufacturing defect.”¹³³ Despite popular belief to the contrary, extended legal guarantees have not typically been associated with greater product durability and could lead to

¹³⁰ Cristina Ganapini, *Not yet accessible, affordable nor mainstream: campaigners tighten the screw on new EU Right to Repair proposal*, Repair.eu (Mar. 22, 2023), available at <https://repair.eu/news/not-yet-accessible-affordable-nor-mainstream-campaigners-tighten-the-screw-on-new-eu-right-to-repair-proposal/>.

¹³¹ *Id.*

¹³² *Id.*

¹³³ Cristina Ganapini, *Webinar: Is the legal guarantee the right tool to make products last longer?*, Repair.eu (June 22, 2023), available at <https://repair.eu/news/webinar-is-the-legal-guarantee-the-right-tool-to-make-products-last-longer/>.

rebound effects such as manufacturers cutting costs in production and independent repairers losing post-warranty business.¹³⁴

In France, since January 1, 2021, manufacturers of electronic products have been required to give their products a repairability score on a scale of 0–10, published at point of sale. The French Repairability Index (FRI) considers documentation availability, disassembly difficulty, availability of spare parts, price of spare parts, and some other criteria specific to each product category covered (currently, washing machines, televisions, smartphones, laptops, lawn mowers, dishwashers, high-pressure cleaners, and vacuum cleaners).¹³⁵ Even manufacturers have acknowledged the consumer power of the FRI: A Samsung-commissioned survey found that less than three months after its introduction, 71% of French consumers had heard of the FRI and 8 out of 10 said they would be willing to give up their favorite brand for a more repairable product.¹³⁶ Since the introduction of the FRI, Petitioner PIRG has annually evaluated manufacturers' disassembly scores and has seen modest improvements—between 2022 and 2023, cell phone disassembly scores rose 13% across the board, which could be evidence “that repair scores incentivize manufacturers to design repairable products.”¹³⁷ At the beginning of 2024, the FRI will be supplanted by a durability index that includes repairability as one category. Repair advocates broadly celebrate the FRI but point to potential weaknesses in its verifiability and lack of controls to ensure manufacturers do not dramatically change their parts pricing after

¹³⁴ *Id.*

¹³⁵ Directorate for Legal and Administrative Information, *The Repairability Index is extended to new products from 4 November 2022*, République Française (Oct. 31, 2023), available at <https://www.service-public.fr/particuliers/actualites/A14590?lang=en>.

¹³⁶ Samsung Newsroom, Les Français et l'indice de réparabilité : un sondage OpinionWay pour Samsung, Samsung (May 18, 2021), available at <https://news.samsung.com/fr/sondage-indice-reparabilite>.

¹³⁷ Lucas Gutterman, *Failing the Fix: Grading laptop and cell phone companies on the fixability of their products*, U.S. PIRG Education Fund (Feb. 2023), available at <https://publicinterestnetwork.org/wp-content/uploads/2023/02/2023-Failing-the-Fix-PIRG.pdf>.

scoring.¹³⁸ The FRI has inspired similar efforts elsewhere: The EU Commission has published a draft proposal for an EU-wide repairability index,¹³⁹ and Belgium¹⁴⁰ and Taiwan¹⁴¹ have each announced a plan to develop a repairability index.

As of decrees passed in 2022 and 2023, France also now requires that for laptops, smartphones, bicycles, e-bikes, and some other DIY equipment, spare parts must be available for at least five years after the last device is placed on the market.¹⁴² France, Belgium, and Germany have piloted or introduced programs by which the government subsidizes the cost of repair.¹⁴³

Although the European ecodesign approach and FRI approach to right to repair have some weaknesses, they nevertheless represent an improvement over the U.S. status quo, as well as a baseline for what is possible in the repair regulatory space. Given the Commission's close work with European competition authorities, the Commission is the U.S. agency best positioned to ensure, to the greatest extent possible, the harmonization of domestic and international standards. This would provide clarity and efficiency to manufacturers, recognizing the interconnectedness of global supply chains and the need for uniform standards.

C. Why a Rule Under Section 5 Is Necessary and Appropriate

Section 5 empowers the FTC to address “unfair methods of competition in or affecting commerce, and unfair or deceptive acts or practices in or affecting commerce.” 15

¹³⁸ Martin DePypere, *The French repair index: challenges and opportunities*, Repair.eu (Feb. 3, 2021), available at <https://repair.eu/news/the-french-repair-index-challenges-and-opportunities/>.

¹³⁹ *Commission Delegated Regulation (EU) .../... supplementing Regulation (EU) 2017/1369 of the European Parliament and of the Council with regard to the energy labelling of smartphones and slate tablets*, European Commission (Aug. 31, 2022), available at [https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=PI_COM:Ares\(2022\)6031464](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=PI_COM:Ares(2022)6031464).

¹⁴⁰ Zakia Khattabi, *Belgium becomes the second European country to introduce a repairability index* (June 2, 2023), available at <https://khattabi.belgium.be/en/pr-repairindex>.

¹⁴¹ Liu Yake, *Taiwan plans to introduce Repairability Index scheme for IT equipment*, Envilience Asia (June 9, 2023), available at https://envilience.com/regions/east-asia/tw/report_10305.

¹⁴² *Right to Repair Progress*, iFixit (2023), available at <https://www.ifixit.com/right-to-repair-progress>.

¹⁴³ *Spare parts and repairs: A right in Europe?* European Consumer Centre France (July 11, 2023), available at <https://www.europe-consommateurs.eu/en/shopping-internet/spare-parts-and-repairs.html>.

U.S.C. 45(a)(1). Unlike other portions of the FTC Act, the unfair methods of competition provision empowers the Commission to address practices that widely harm consumers but may be difficult to address under the Sherman and Clayton Acts and other antitrust statutes.¹⁴⁴

In 2022, the FTC issued a Policy Statement Regarding Section 5 Enforcement.¹⁴⁵ The Statement reviewed the history of Section 5, noting that the FTC Act was passed to push back against the judicial adoption of the open-ended rule of reason to analyze Sherman Act claims.¹⁴⁶ The Statement thus affirmed the FTC’s longstanding position—supported amply by Supreme Court and lower court precedent—that “Section 5 reaches beyond the Sherman and Clayton Acts to encompass various types of unfair conduct that tend to negatively affect competitive conditions.”¹⁴⁷ That is, “Section 5 reaches ‘conduct which, although not a violation of the letter of the antitrust laws, is close to a violation or is contrary to their spirit.’”¹⁴⁸ Moreover, the Statement notes that in Section 5 Congress “evinced a clear aim that ‘unfair methods of competition’ need not require a showing of current anticompetitive harm or anticompetitive intent in every case.”¹⁴⁹

In the Statement, FTC also notes that “[g]iven the distinctive goals of Section 5, the inquiry will not focus on the ‘rule of reason’ inquiries more common in cases under the Sherman Act, but will instead focus on stopping unfair methods of competition in their incipency based

¹⁴⁴ FTC, *Statement of the Commission on the Withdrawal of the Statement of Enforcement Principles Regarding “Unfair Methods of Competition” Under Section 5 of the FTC Act* (July 9, 2021), <https://www.ftc.gov/legal-library/browse/statement-commission-withdrawal-statement-enforcement-principlesregarding-unfair-methods>.

¹⁴⁵ FTC, *Policy Statement Regarding the Scope of Unfair Methods of Competition Under Section 5 of the Federal Trade Commission Act*, Comm. File No. P221202 (Nov. 10, 2022) (hereinafter “2022 Policy Statement”), available at https://www.ftc.gov/system/files/ftc_gov/pdf/P221202Section5PolicyStatement.pdf.

¹⁴⁶ *Id.* at 2-4; see *Standard Oil Co. of New Jersey v. United States*, 221 U.S. 1, 60 (1911).

¹⁴⁷ 2022 Policy Statement at 1.

¹⁴⁸ *Id.* at 8 (quoting *E.I. du Pont de Nemours v. Fed. Trade Comm’n (Ethyl)*, 729 F.2d 128, 136 (2d Cir. 1984)).

¹⁴⁹ *Id.* at 4.

on their tendency to harm competitive conditions.”¹⁵⁰ In this way, under Section 5 FTC may prohibit or regulate conduct that may fall into a “gap” in the antitrust laws.¹⁵¹

This does not mean, however, that the reach of Section 5 is limitless. The Policy Statement notes that in order for a practice to violate Section 5, the conduct must (1) be a method of competition undertaken by an actor in the marketplace, and (2) be unfair, meaning it goes beyond competition on the merits.¹⁵² With respect to the latter, the Statement lays out two factors that guide its determination of what constitutes conduct beyond competition on the merits, which it weighs on a “sliding scale” (*i.e.*, a strong showing of one factor can mitigate the extent to which the other must be shown):

First, the conduct may be coercive, exploitative, collusive, abusive, deceptive, predatory, or involve the use of economic power of a similar nature. It may also be otherwise restrictive or exclusionary, depending on the circumstances. . . . Second, the conduct must tend to negatively affect competitive conditions. This may include, for example, conduct that tends to foreclose or impair the opportunities of market participants, reduce competition between rivals, limit choice, or otherwise harm consumers.¹⁵³

Most repair restrictions discussed in this Petition’s preceding sections clearly satisfy each of these requirements. First, repair restrictions are a “method of competition” because they are not “merely [an inherent] condition of the marketplace, . . . such as high concentration or barriers to entry.”¹⁵⁴ Rather, they are unilaterally (and, in many markets, only recently) imposed by manufacturers.

Second, repair restrictions also undoubtedly go beyond “competition on the merits,” because they satisfy both factors FTC has laid out for making that determination. First, they are

¹⁵⁰ *Id.* at 10.

¹⁵¹ *Id.* at 13.

¹⁵² *Id.* at 8.

¹⁵³ *Id.* (citing caselaw and the FTC Act’s legislative history).

¹⁵⁴ 2022 Policy Statement, *supra*, n.145, at 8 (citing *Ethyl*, 729 F.2d at 139).

“coercive,” “exploitative,” and “abusive” insofar as they are designed to lock consumers into either obtaining repairs or new equipment from the same manufacturer, thereby raising prices for consumers. *See supra* Section IV.A. They may also be “deceptive” if, through hidden warranty conditions or a decision to make parts for older models unavailable, the consumer would have no way of knowing the restriction would be imposed. *Supra* Section III.B.i. Second, repair restrictions affect competitive conditions, because they directly foreclose rivals—whether horizontal competitors in the OEM market or downstream competitors that would compete in the repair market—from offering repair services on the manufacturer’s equipment. *Supra* Section IV.D & IV.E. They in effect artificially inflate the manufacturer’s market power in the aftermarket for repair, a separate market that would enjoy far greater competition absent the manufacturer’s upstream conduct. *Supra* Section IV.E. Promulgating a rule under Section 5 would therefore be entirely consistent with FTC’s own guidance about how that statute should be implemented.

A Section 5 rule targeting repair restrictions would also be consistent with a wide body of scholarship advocating that the statute be used to serve a “gap-filling” role to redress harms that may not be redressable solely under the Sherman and Clayton Acts. For example, one framework proposes permitting claims where FTC has “reason to believe that there has been a violation of the Sherman Act or the Clayton Act, but where there is not yet an established body of precedent to support that view.”¹⁵⁵ Another framework advocates the use of Section 5 to prohibit conduct that “would meet all the economic and legal requirements of a Sherman Act claim, but cannot be brought . . . because of legal limitations imposed for reasons unrelated to the

¹⁵⁵ Thomas B. Leary, *A Suggestion for the Revival of Section 5*, ANTITRUST SOURCE (2009), available at https://www.ftc.gov/sites/default/files/documents/public_events/section-5-ftc-act-competition-statute/tleary.pdf.

goals of antitrust law,” such as the *Noerr-Pennington* or state-action doctrines.¹⁵⁶ These doctrines are interpretive glosses put on the antitrust statutes not to serve competition policy but rather to further other goals (the right to petition the government, and federalism, respectively), but the concerns animating them are drastically lessened when the threat of private treble damages suits and retrospective liability—both of which are unavailable under Section 5—are removed.¹⁵⁷ Similarly, given the artificial barriers to antitrust liability under *Kodak* that some courts of appeals have imposed, *see supra* Section V.A, addressing the unfairness of repair restrictions head on (without needing to show, *e.g.*, a change in manufacturer policy) would mitigate a serious competitive harm that current doctrine has not sufficiently addressed.

Indeed, with respect to repair restrictions in particular, Professor Michael Carrier of Rutgers Law School has persuasively argued that Section 5 liability may be particularly appropriate, because the restrictions effectively demonstrate and amplify market power, particularly in industries in which many or most competing manufacturers impose similar limitations.¹⁵⁸ In particular, he highlights five scenarios that prevent consumers from having real choice when manufacturers impose limitations on consumers’ ability to repair their own devices or equipment—most of which are present in the product markets where repair restrictions are most commonplace: 1) the imposition of restrictive terms by multiple manufacturers; 2) a manufacturer’s control over a separate level of the distribution chain; 3) users’ lack of knowledge of restrictions; 4) multiple generations of purchasers continuing to buy products even with suffocating policies in place; and 5) time-sensitive uses (*e.g.*, the need for a repair to be done

¹⁵⁶ *See, e.g.*, Susan A. Creighton & Thomas G. Krattenmaker, *Appropriate Role(s) for Section 5* at 3, 5-6, ANTITRUST SOURCE (Feb. 2009), available at <https://www.wsgr.com/a/web/26/creighton0209.pdf>.

¹⁵⁷ *Id.* at 5.

¹⁵⁸ *See generally* Michael Carrier, *How the Federal Trade Commission Can Use Section 5 to Strengthen the Right to Repair*, 37 Berkeley Tech. L.J. 1145 (2022), available at <https://btlj.org/wp-content/uploads/2023/06/0006-37-3-Carrier.pdf>.

quickly to avoid a material loss of income).¹⁵⁹ Citing FTC’s empirical findings in *Nixing the Fix*, Carrier also explains the “uniquely severe anticompetitive effects” in the form of “effects on lives and livelihoods . . . not presented in previous Section 5—or, for that matter, antitrust—cases.”¹⁶⁰ And he highlights the “questionable” nature of the procompetitive justifications offered by manufacturers,¹⁶¹ which are discussed and rebutted in more detail in Section VI below.

In sum, given the proven inability of current antitrust doctrine to prevent the enormous growth of repair restrictions across the economy—and the clear harm to consumers and competitive conditions they inflict—such conduct is a prime candidate for regulation under the Commission’s Section 5 authority.

D. Components of an Effective Rule

The Commission made clear in its *Nixing the Fix* report that it understands the economic scope of the problem of repair restrictions and the myriad ways manufacturers implement them to harm competition across industries. Given its familiarity with the problem, as well as its institutional expertise in weighing the costs and benefits of a new rule’s particulars, the Commission is well suited to craft the specific language of a regulation targeting such restrictions. To aid the Commission in that task, Petitioners respectfully submit several considerations that, based on past successful efforts to regulate comparable problems, should guide the Commission in its drafting.

Any proposed rule in this space ideally will aim to address these reasonable consumer expectations of product repair:

¹⁵⁹ *Id.* at 1176-78.

¹⁶⁰ *Id.* at 1179, 1181.

¹⁶¹ *Id.* at 1181.

- Consumable components ought to be replaceable and readily available throughout a product's usable lifespan;
- Components that commonly break ought to be replaceable and readily available as repair parts;
- Consumers ought to be able to choose to take damaged products to a repair shop of their choice, or perform a repair themselves;
- When a manufacturer discontinues support for a product, its key functions ought to remain intact, and an independent repair shop ought to be able to continue to perform repairs;
- Identical components from two identical devices ought to be interchangeable without manufacturer intervention;
- Independent repair shops ought not be required to report customers' personally identifiable information to the manufacturer.

These expectations could be secured by establishing rules that prohibit particular repair-restrictive acts (such as destructive disassembly), require particular repair-supportive acts (such as making spare parts available), or require manufacturers to disclose information about repair or their products' repairability. Sections III.D.i–III.D.iii below sketch out some possible rules in these spaces.

i. Repairability Scoring

Consumers should be able to, at a glance, understand how repairable a product is. Repairability scoring on labels at the point of sale accomplishes that goal. By distilling complicated information down to a simple score, consumers can understand what they are buying without arduous research. The FTC has already sought public comment on adding repair

information to the Energy Guide labels required on many appliances, which Petitioners propose as an ideal display space for appliance energy labeling.¹⁶² By utilizing the existing program, consumers will be able to quickly assess the energy usage of an appliance across its entire lifespan, including repairs. A repairability scoring system should apply both to the appliances covered under Energy Guide and to home electronics.

An effective repairability score should take into account, at a minimum, (1) the ease of disassembly for purposes of repair, (2) the availability of repair manuals, (3) the availability of spare parts, (4) whether software contains unnecessary obstacles like digital locks, and (5) the expected end of life of the product, including how long the product will receive software updates, defect support and warranty periods, and service material availability. All of these criteria can be defined by experts and independently verified, making them well-suited to a scoring system. A national U.S. repairability scoring system might well be modeled on the French Repairability Index, although it would ideally address weaknesses of the French system, including missing controls on parts pricing, a lack of transparency about part availability, and some means of addressing repair restrictions such as exclusive dealing and parts pairing.

ii. Exclusivity of Parts and Parts Pairing

Consumers should not be at the mercy of a manufacturer's self-serving policies regarding the availability of parts when they try to repair products they have purchased. Manufacturers should be barred from, for instance, requiring that independent repair shops buy parts from preapproved exclusive vendors.¹⁶³ Likewise, manufacturers should be barred from using

¹⁶² Federal Trade Commission, *Federal Trade Commission Seeks Public Comment on Initiative to Reduce Energy Costs and Strengthen Right-to-Repair* (Oct. 17, 2022), <https://www.ftc.gov/news-events/news/press-releases/2022/10/federal-trade-commission-seeks-public-comment-initiative-reduce-energy-costs-strengthen-right-repair>.

¹⁶³ See, e.g., Daniel Hanley, *The First Thing a Biden FTC Should Tackle*, Slate (Nov. 18, 2020), <https://slate.com/technology/2020/11/biden-ftc-right-repair-exclusive-contracts.html> (Apple iPhone parts).

exclusive contracts with their component suppliers, such that those suppliers are contractually barred from selling components or parts, especially microchips, to independent repair providers.¹⁶⁴ Manufacturers usually sell expensive circuit board assemblies rather than individual microchips.¹⁶⁵ Independent repair shops can differentiate themselves by replacing individual microchips but are frequently blocked by exclusive contracts.¹⁶⁶ These manufacturer policies serve only to harm consumers.

Manufacturers should also be barred from parts pairing, the practice of using a software barrier to prevent consumers or independent repairers from replacing parts without manufacturer approval. Parts pairing should be the exception, permitted only when there is a true justification for it. Parts pairing has allowed insidious marketing practices to confuse consumers. For instance, the iPhone 14 appears well-designed for repair—a consumer can disassemble it, replace a broken part, and reassemble it.¹⁶⁷ And Apple has been designing newer iPhones so consumers can take them apart and put them back together more easily than in the past.¹⁶⁸ However, in practice those repairs are significantly hindered by parts pairing: while the consumer can replace the part, only Apple can “authenticate” the repair, returning the device to full functionality—otherwise, features such as FaceID, battery health, or display color adjustments will be unavailable.¹⁶⁹ Effectively, only Apple-authorized repairers can fix devices completely. The

¹⁶⁴ Petition for Rulemaking to Prohibit Exclusionary Contracts, Open Markets Institute, 31 (July 21, 2020), *available at* <https://static1.squarespace.com/static/5e449c8c3ef68d752f3e70dc/t/5f1729603e615a270b537c3d/1595353441408/Petition+for+Rulemaking+to+Prohibit+Exclusionary+Contracts.pdf>.

¹⁶⁵ *Id.*

¹⁶⁶ *Id.*

¹⁶⁷ Kyle Wiens, *We Are Retroactively Dropping the iPhone's Repairability Score*, iFixit (Sept. 19, 2023), <https://www.ifixit.com/News/82493/we-are-retroactively-dropping-the-iphones-repairability-score-en>.

¹⁶⁸ *Id.*

¹⁶⁹ *Id.*

issue is confusing to the average consumer, who would see that the device is designed for repair and not realize that the device cannot actually be repaired, except by Apple-authorized shops.

iii. Minimum Standards for Support and Documentation

When a consumer buys a gallon of milk, the label states clearly when the milk is likely to go bad. However, when a consumer buys a device which connects to the internet and needs periodic updates for compatibility and security, there is no requirement that the manufacturer offers a minimum software service window for that device. Often, there is no indication that the device has any issues until a security alert warns the consumer that the device is no longer supported and will not be permitted to connect to various web services, or the device might simply fail without explanation. In other cases, there is no indication that the device is insecure and the consumer is left exposed to hacking and other security threats.

This issue was recently raised by Petitioner PIRG around Chromebooks used in schools.¹⁷⁰ Schools rushed to buy Chromebooks at the start of the pandemic and throughout the summer of 2020 but were often unaware that each device had a service end date, after which it would be unable to receive software updates.¹⁷¹ Once that date was reached, the computers were prevented from using software tools like Google Classroom or accessing state testing websites.¹⁷² Schools reported having hundreds or thousands of working laptops that suddenly became unusable.¹⁷³ Google later committed to extending the support lifespan for these devices in response feedback from advocates and school districts,¹⁷⁴ but questions remain: how long

¹⁷⁰ Lucas Gutterman, *'Chromebook Churn' Report Highlights Problems of Short-Lived Laptops in Schools*, U.S. PIRG (Apr. 18, 2023), <https://pirg.org/edfund/resources/chromebook-churn-report-highlights-problems-of-short-lived-laptops-in-schools/>.

¹⁷¹ *Id.*

¹⁷² *Id.*

¹⁷³ *Id.*

¹⁷⁴ Prajakta Gudadhe & Ashwini Varma, *Chromebooks Will Get 10 Years of Automatic Updates*, The Keyword (Sept. 14, 2023), <https://blog.google/outreach-initiatives/education/automatic-update-extension-chromebook/>.

should consumers expect support, what are the disclosure requirements around that time span, and what happens after manufacturers decide to end periodic updates?

Software should not be the reason working devices are pushed into the waste stream—absent a compelling justification (usually none is offered), manufacturers should support devices for the life of the physical hardware. Failing that, the manufacturer should open up the support environment to allow for community members to provide security and compatibility updates using, for example, the open-source software model for community software support. Finally, consumers should be given information about how long the manufacturer is pledging to support a device’s software, similarly to how consumers can easily read a best-by date in the grocery store.

Additionally, some products are made without spare parts in stock anywhere, or without critical service information, technical diagrams and schematics, or other service materials, even for the manufacturer’s authorized repair providers. Even if right to repair laws pass in individual states, consumers will still attempt to fix products only to learn that there is no sufficient documentation or parts support to allow a technician to complete the repair. When a company manufactures a device over a certain cost threshold, it should be required to produce some minimum level of service documentation. Those would include a wiring diagram and circuit board schematic, as well as a parts inventory. These materials would allow a technician to complete repairs long after the manufacturer no longer offers repair services. For example, because circuit schematics are available for early models of televisions, radios, and CB transmitters, there is a vibrant community of repair enthusiasts keeping those devices alive.¹⁷⁵ John Rider’s “The Perpetual Troubleshooter’s Manual” provides schematics for thousands of

¹⁷⁵ Al Williams, *How to Repair? The Death of Schematics*, Hackaday (Nov. 21, 2022), available at <https://hackaday.com/2022/11/21/how-to-repair-the-death-of-schematics/>.

such devices, going back to 1931.¹⁷⁶ SecuRepairs founder Paul Roberts described his experience fixing a ca. 1965 KLH Model 21 radio compared to a 2021-model FitBit Charge 4.¹⁷⁷ The circuit schematic available for the radio allowed Roberts to identify the bad part (the power cord), solder it back on, identify and order a fuse that detached in the process, and replace that also. The FitBit, on the other hand, had no available repair documentation or parts available, and when Roberts submitted an inquiry to the manufacturer it simply sent him a new device.¹⁷⁸

Requiring that manufacturers support repair and provide documentation for a period after purchase would allow consumers to repair devices themselves or utilize independent repair shops. Doing so would also foster competition in the repair market throughout that period, pushing prices down for consumers.

iv. Other Possible Rules

Although Petitioners see the Commission as particularly well-suited to these three rulemaking spaces, a rule could productively address repair restrictions from other angles. For instance, to address the problem that sealed-in batteries are difficult to replace and limit the lifespan of a device to the lifespan of its battery, a rule might prohibit glued-in or soldered-in batteries; it might alternatively require manufacturers to disclose the expected charge cycle lifespan of batteries or disclose any barriers to replacement of that battery; or it might require that replacement batteries be available for a certain number of years after a product is discontinued. A rule to address the problem of destructive disassembly, whereby products cannot be opened without being destroyed, might similarly prohibit the use of non-repeatable fasteners

¹⁷⁶ John F. Rider, *Perpetual Troubleshooter's Manual – 1930 to 1952 – Complete Collection*, available at <https://www.worldradiohistory.com/Rider-Manual.htm>.

¹⁷⁷ Paul Roberts, *Repair-off: 10-month-old Fitness Tracker vs. 55-year-old Radio*, PIRG (Sept. 20, 2021), available at <https://pirg.org/edfund/articles/repair-off-10-month-old-fitness-tracker-vs-55-year-old-radio/>.

¹⁷⁸ *Id.*

or require their disclosure on product packaging. Any of these rules would help protect customers' right to repair their belongings as they see fit.

VI. Refuting Arguments Against the Promulgation of a Right to Repair Rule

A. Independent Repair Has the Same Track Record of Safety as Manufacturer-Authorized Repair

While manufacturers often claim that their own repairs of products are safer than independent repairs, the Commission noted in *Nixing the Fix* that it has found no evidence to support this claim.¹⁷⁹ Independent repair businesses hire from the same labor pool of trained and experienced technicians as manufacturers' brand-authorized repair centers. The FTC itself found that manufacturers sometimes deliberately design products to make independent repairs less safe as a strategy for undercutting independent repair businesses.¹⁸⁰

Workplace injuries are also not a concern justifying repair restrictions. The U.S. Bureau of Labor Statistics reports that the electronics repair industry has six times fewer occupational injuries than the national average.¹⁸¹

Manufacturers often point to the dangers of lithium-ion batteries to argue that repair of electronics is dangerous and therefore ought to be under manufacturer control. However, electronics industry safety experts refute these concerns: As the German independent safety inspection company Technischer Überwachungsverein (TÜV SÜD) explained, "Lithium-ion batteries are generally safe. If you follow proper storage, charging, and discarding procedures,

¹⁷⁹ *Nixing the Fix*, *supra* n.8, at 28.

¹⁸⁰ *Id.* at 19-21.

¹⁸¹ In 2020, the electronics repair industry reported 0.3 cases of injury requiring time away from work per 100 workers, compared to 1.8 cases per 100 on average. *See* Bureau of Labor Statistics, *Injuries, Illnesses, and Fatalities*, U.S. Dep't of Labor (2021), https://www.bls.gov/web/osh/summ1_00.htm#soii_n17_as_t1.f.1.

they are unlikely to fail or catch fire.”¹⁸² The FTC found no evidence that injuries are tied to independent or do-it-yourself repair.¹⁸³

Further, lithium-ion batteries do not seem to pose a fire risk larger than that of other flammable goods commonly found in businesses or products sold to laypersons, such as gasoline and propane. Although manufacturers sometimes point to the rise in electric vehicle lithium-ion battery fires to demonstrate the potential risk of repair, TÜV SÜD found that damage from a gasoline-powered vehicle fire is no different from an electric vehicle fire. Accordingly, the National Fire Prevention Association found that lithium-ion battery fires have “similar fire development” to other kinds of fires.¹⁸⁴

B. Right to Repair Ensures Repairs are Done Correctly and Sustainably

Right to repair requirements only mandate that manufacturers provide the parts, tools, and information necessary to diagnose a problem and complete a repair. Any rule promulgated by the Commission would not require the dissemination or approval of illegal modification tools.

The owner of the device is still responsible for ensuring that they comply with all relevant safety and environmental regulations. Those regulations are enforced by other agencies like the U.S. Environmental Protection Agency, which has levied many millions of dollars in civil penalties against sellers of illegal devices that defeat emissions control systems for engines.¹⁸⁵ Right to repair rulemaking would not affect these regulations or their enforcement.

¹⁸² TÜV Sud, *Lithium-ion battery fires: Myth vs. reality* (2022), available at <https://www.tuvsud.com/en-us/resource-centre/stories/lithium-ion-battery-fires-myth-vs-reality>.

¹⁸³ *Nixing the Fix*, *supra* n.8, at 28.

¹⁸⁴ R. Thomas Long, Jr., et al. *Lithium ion batteries hazard and use assessment: Phase IIB*, The Fire Protection Research Foundation, National Fire Prevention Association (2013), available at <https://www.nfpa.org/-/media/Files/News-and-Research/Fire-statistics-and-reports/Hazardous-materials/RFLithiumIonBatteriesIIB.ashx>.

¹⁸⁵ *Enforcement Alert: Aftermarket Defeat Devices and Tampering Are Illegal and Undermine Vehicle Emissions Controls*, U.S. E.P.A., Off. of Enforcement and Compliance Assurance (2020), available at <https://www.epa.gov/sites/default/files/2020-12/documents/tamperinganddefeatdevices-enfalert.pdf>.

In fact, right to repair rules and legislation are a huge boon for the environment, keeping working products in use longer. Microsoft commissioned a study which found local repair reduces greenhouse gas emissions by up to 89% compared to factory repair.¹⁸⁶ Additionally, independent repair technicians can continue to provide repairs for older devices after the manufacturer stops supporting repair, extending the useful life of devices and thereby reducing the need for manufacture of new ones.

If a repair provider makes a mistake that results in an injury or loss, existing bodies of negligence and tort law govern the assignment of liability. Right to repair rulemaking would thus not assign any additional liability to manufacturers for a badly repaired product. When manufacturers have made parts, tools, and information available to independent shops and consumers, they typically include liability release in the terms of service.¹⁸⁷ Any rule adopted by the Commission in response to this Petition need not curtail manufacturers' ability to limit liability in this way.

C. Right to Repair Protects Cybersecurity and Privacy

According to industry experts, there is “no cybersecurity risk in third-party repair.”¹⁸⁸ Securely designed products cannot be undermined by repair technicians, whether manufacturer-authorized, independent, or consumer. Manufacturers do not provide authorized repair technicians with information that would undermine security, because they know those secrets would not be kept by their broad service networks. If secrecy of repair information is the only

¹⁸⁶ Oakdene Hollins, *An assessment of the greenhouse gas emissions and waste impacts from improving the repairability of Microsoft devices*, at 4, Microsoft (Apr. 22, 2022), available at <https://www.dropbox.com/s/0s1lm6efee7cbu/Summary%20of%20Sustainability%20Benefits%20of%20Microsoft%20Device%20Repair.pdf?dl=0>.

¹⁸⁷ See, e.g., Apple, “Repair Terms and Conditions” (2022), available at <https://www.apple.com/legal/sales-support/terms/repair/generalservice/servicetermsen/>.

¹⁸⁸ Richard Forno, *Challenging Cybersecurity as the Reason to Oppose the Consumer Right to Repair*, Stanford Law School, Ctr. for Internet and Society (2021), available at <http://cyberlaw.stanford.edu/blog/2021/01/challenging-cybersecurity-reason-oppose-consumer-right-repair>.

thing keeping products secure, they are not secure. Cybersecurity professionals often state that “there is no security through obscurity.”¹⁸⁹ Security is provided through secure design as shown through testing and improvement, not through concealing the workings of a product.¹⁹⁰

Right to repair rulemaking would supply independent repair technicians with the same tools already provided to authorized repair technicians. As the FTC has previously noted, “The record contains no empirical evidence to suggest that independent repair shops are more or less likely than authorized repair shops to compromise or misuse customer data.”¹⁹¹

D. Manufacturer-Authorized Repair Services Are Insufficient to Meet People’s Needs

When the only available repair service is manufacturer-authorized repair, consumers often experience long wait times, high prices without competition or alternatives, delays in shipping and repair, and limits to the types of repairs available.

The FTC has received complaints about long wait times and repair delays across industries, including from Apple product owners, from Marine Officers concerned about military equipment, and from farmers trying to repair planting and harvesting equipment.¹⁹² And the COVID-19 pandemic “has exacerbated the effects of repair restrictions on consumers,” particularly regarding wait times.¹⁹³

Manufacturers sometimes point to their systems for enabling independent shops to become authorized (or partially authorized) to perform repairs. However, often these programs sell parts to those shops at exorbitant prices and offer much worse tools and documentation than they provide to their favored service providers. Electronics repair shop owners have publicly

¹⁸⁹ Securepairs.org, *Statement of Principles: Obscurity* (2020), available at <https://securepairs.org/statement-of-principles/#obscurity>.

¹⁹⁰ *Id.*

¹⁹¹ *Nixing the Fix*, *supra* n.8, at 31.

¹⁹² *Id.* at 39.

¹⁹³ *Id.* at 4.

described Apple’s Independent Repair Provider (IRP) program as “a joke.”¹⁹⁴ The agreement requires that independent repair shops “agree to unannounced audits and inspections by Apple, which are intended, at least in part, to search for and identify the use of ‘prohibited’ repair parts”—audits which Apple can continue to conduct up to five years after a shop leaves the program.¹⁹⁵ Apple also points to its self-service repair program (“IRP”), through which the company sells parts to individuals and independent shops for some common repairs. However, the program is only available for a limited set of devices and a limited set of repairs; for example, it does not include the rear glass, charge port, or earpiece speaker for iPhones—or any parts at all for iPads.¹⁹⁶ Even independent repair shops who are not part of the IRP program have reduced ability to do these sorts of repairs due to Apple’s parts pairing system, which limits the functionality of many swapped or third-party parts.¹⁹⁷

E. Voluntary Agreements Are Inadequate to Address Repair Concerns

Manufacturers in both the automotive and agricultural industries have aimed to address repair concerns via voluntary Memorandum of Understanding (MOU) agreements. In all cases, however, those agreements have failed to solve repair problems comprehensively. The automotive Right to Repair MOU of 2014, for example, explicitly excluded telematics data; today, many repairs’ diagnostic procedures require access to telematics data.¹⁹⁸ The reaffirmed automotive repair MOU of 2023 requires manufacturers to provide this data only conditionally,

¹⁹⁴ Audrey Conklin, *Independent Repair Shops Disappointed with Apple’s Repair Programs*, Fox Business (Feb. 14 2020), available at <https://www.foxbusiness.com/technology/apple-right-to-repair>.

¹⁹⁵ Maddie Stone, *Apple’s Independent Repair Program is invasive to shops and their customers, contract shows*, Vice (Feb. 6, 2020), available at <https://www.vice.com/en/article/qjdjnv/apples-independent-repair-program-is-invasive-to-shops-and-their-customers-contract-shows>.

¹⁹⁶ Service Parts or Tools, Inc., *Self-service repair* (2023), Apple, available at <https://www.selfservicerepair.com/>.

¹⁹⁷ Kyle Wiens, *iPhone 15 teardown reveals software lockdown*, iFixit (Sept. 25, 2023), available at <https://www.ifixit.com/News/82867/iphone-15-teardown-reveals-software-lockdown>.

¹⁹⁸ Auto Care Association, Mass. Right to Repair (2023), available at <https://www.autocare.org/government-relations/current-issues/right-to-repair>.

and it suffers also from the problem of enforcement, as it is non-binding and includes no consequences of manufacturer non-compliance.¹⁹⁹

MOUs promoted by agricultural equipment manufacturers have had very similar issues. The MOUs offered only repair software that was deliberately scrubbed of important procedures and repair-authorizing capabilities. Manufacturers and dealers have repeatedly failed to meet their self-imposed deadlines for availability of tools. Again, there is no mechanism of enforcement and no recourse for farmers who do not feel well served by the MOU. Montana farmer Walter Schweitzer called the MOUs “pinky swears,” saying, “I’m running out of pinkies and I still can’t fix my damn tractor.”²⁰⁰

Both automotive and agricultural MOUs have appeared to be intended to head off repair legislation, and the agricultural MOU included a provision requiring that the American Farm Bureau Federation cease repair advocacy.²⁰¹

F. Green Standards Overrepresent Manufacturer Voices

Sometimes manufacturers will point to green standards as another place where repair regulation ought to be housed instead of legislation and government enforcement bodies. However, many major electronics standards have weakened instead of strengthened over time: instead of adjusting to continue to drive the market forward, standards have a tendency to stagnate at the point that manufacturers find readily achievable.

The federal green procurement standard EPEAT, for example, launched with no products at its highest “gold” tier,” but by 2017, 64% of registered products met that highest tier and 97%

¹⁹⁹ Aftermarket News, *Hanvey: ‘OEM Right to Repair MOU an inadequate solution’* (July 17, 2023), available at <https://www.aftermarketnews.com/hanvey-oem-right-to-repair-mou-an-inadequate-solution/>.

²⁰⁰ Kevin O’Reilly, *Another tractor repair MOU changes nothing* (March 9, 2023), PIRG, available at <https://pirg.org/articles/another-tractor-repair-mou-changes-nothing/>.

²⁰¹ Elizabeth Chamberlain, *Deere promised farmers the Right to Repair. Can we trust them?* (Jan. 10, 2023), iFixit, available at <https://www.ifixit.com/News/70877/deere-promised-farmers-the-right-to-repair-can-we-trust-them>.

of products were either silver or gold.²⁰² The addition, removal, or amendment of standards criteria typically requires “consensus” approval (between 66 and 75% usually), and because manufacturers make up such a large portion of standards development boards, their voices end up overrepresented.²⁰³

G. Right to Repair Reduces E-Waste

Electronic waste is toxic to human health when landfilled, incinerated, or improperly recycled. It can release heavy metals and persistent organic pollutants, which have both immediate and bioaccumulating effects.²⁰⁴ Manufacturers have repeatedly pointed to a study finding that in 2020, total e-waste volume had declined 10% since 2015.²⁰⁵ But the authors of that study reject the suggestion that manufacturer takeback programs explain the decline.²⁰⁶ Instead, the researchers explain that consumer electronics have changed significantly in the last two decades—some devices that were once large and heavy (like cathode ray tube televisions) are now smaller and lighter. In any event, reported numbers are likely to understate the problem given that, as the EPA’s Office of Inspector General recognized in a 2013 report, there is no “uniform definition of E-waste and adequate information on E-waste disposition.”²⁰⁷

²⁰² Mark Schaffer, *Electronics standards are in need of repair: Manufacturers have weakened U.S. green electronics standards by resisting repair criteria* at 14 (Aug. 2017), The Repair Association, available at <https://static1.squarespace.com/static/53821f30e4b07bcdae103594/t/5982ea72e6f2e1930e9b4bb8/1501751930833/Report+-+Electronic+Standards+Are+In+Need+of+Repair.pdf>.

²⁰³ *Id.* at 14.

²⁰⁴ Ming Man, Ravi Naidu, and Ming H. Wong, *Persistent Toxic Substances Released from Uncontrolled E-Waste Recycling and Actions for the Future* at 463-64, *Science of the Total Environment* (Oct. 1, 2013), available at <https://pubmed.ncbi.nlm.nih.gov/22840636/>.

²⁰⁵ Shahana Althaf, Callie W. Babbitt, and Roger Chen, *The Evolution of Consumer Electronic Waste in the United States*, J. of Indus. Ecol., vol. 25 (2020), <https://onlinelibrary.wiley.com/doi/epdf/10.1111/jiec.13074>.

²⁰⁶ Callie Babbitt and Shahana Althaf, *Consumer Electronics Have Changed a Lot in 20 Years – Systems for Managing E-Waste Aren’t Keeping Up*, *The Conversation* (Jan. 11, 2021), available at <https://theconversation.com/consumer-electronics-have-changed-a-lot-in-20-years-systems-for-managing-e-waste-arent-keeping-up-147972>.

²⁰⁷ Office of Inspector General, *Improved Information Could Better Enable EPA to Manage Electronic Waste and Enforce Regulations* at 9, U.S. EPA (June 21, 2013), available at <https://www.epaig.gov/sites/default/files/2015-09/documents/20130621-13-p-0298.pdf>.

Global measures of e-waste find it still to be growing dramatically, up 21% from 2015 to 2020.²⁰⁸ And even at smaller volumes, e-waste makes up a significant portion of toxic trash: In the US, “e-waste already accounts for 70% of the heavy metals” found in the waste stream.²⁰⁹

Plus, focusing only on e-waste hides the enormous environmental costs of electronics manufacturing. For example, 81% of the energy a laptop uses in its lifetime is consumed during manufacturing, not during use by consumers, and mining for the materials in electronics is incredibly destructive.²¹⁰ Keeping electronics in use instead of in the waste stream reduces environmental costs.

VII. Conclusion

For the foregoing reasons, Petitioners PIRG and iFixit respectfully request that the Commission initiate rulemaking to protect consumers’ right to repair their devices to prevent unfair methods of competition.

²⁰⁸ Vanessa Forti, *Global Electronic Waste up 21% in Five Years, and Recycling Isn’t Keeping Up*, The Conversation (July 10, 2020), available at <https://theconversation.com/global-electronic-waste-up-21-in-five-years-and-recycling-isnt-keeping-up-141997>.

²⁰⁹ Man et al., *Persistent Toxic Substances*, *supra* n.204.

²¹⁰ Vaclav Smil, *Your Phone Costs Energy—Even Before You Turn It On*, IEEE Spectrum (Apr. 26, 2016), available at IEEE <https://spectrum.ieee.org/your-phone-costs-energyeven-before-you-turn-it-on>.