

INSIGHTS AND RESOURCES

Ensuring Safe, Sustainable E-Mobility Transportation

Letter from the President & CEO



The e-mobility market has grown dramatically, reducing cars on the road, supporting workers in the gig economy, and helping cities meet sustainability goals. Preserving the e-bike and e-scooter market means protecting against the fire risk these devices carry.

E-mobility devices are commonly powered by rechargeable lithium-ion batteries. But if damaged, malfunctioning, modified, counterfeit, or otherwise substandard, these batteries can enter thermal runaway, an uncontrollable, self-heating state that can lead to smoke, fire, toxic off-gassing, or explosion.

Safety standards help protect Americans from deadly battery fires and other safety risks, while also helping preserve access to the e-bikes and e-scooters consumers want.

New York City, in particular, has had a high number of incidents that led its City Council to take legislative action. In 2023, New York City enacted Local Law 39, requiring any company selling, leasing, or distributing micromobility devices, such as electric bikes or electric scooters, to meet safety standards published by UL Standards & Engagement that help to reduce the risk of fire. Since the law took effect in September of that year, the rate of injuries and deaths from e-bike fires has drastically slowed.

We developed the following materials to inform and support government and community leaders interested in learning about lithium-ion battery issues and considering legislative action. UL Standards & Engagement seeks to be a resource and trusted partner in helping you better protect your communities.



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Table of Contents

Lithium-Ion Battery Hazards	05
Reducing E-Bike Fires with Standards	06
How Governments are Handling this Issue	07
Take Action to Drive E-Bike Safety	08
The Cost of E-mobility Fires	09
Perceptions of E-Mobility Battery Safety	10
Where to Learn More	11
Understanding the Battery Power Ecosystem	12
E-mobility Standards	14
About ULSE	15



As society moves toward clean, renewable, and sustainable energy sources, lithium-ion batteries have become a critical power source. These rechargeable batteries are small and compact, yet still capable of storing large amounts of energy. They are also ubiquitous, found in everything from smartphones and e-bikes to electric vehicles and large-scale energy grid storage systems. Standards help prevent the risks and hazards inherent to lithium-ion battery power and support technological progress in clean energy.

Lithium-Ion Battery Hazards



Thermal Runaway

Thermal runaway is a phenomenon in which a lithium-ion cell enters an uncontrollable, self-heating state. This reaction can be caused by substandard quality and design, poor components, physical abuse, and improper charging or discharging. Thermal runaway can result in extremely high temperatures, violent cell venting, fire, and explosion.



Stranded Energy

Stranded energy refers to the remaining energy in a battery after it has been damaged or removed from service. If batteries are not properly managed, stranded energy can lead to thermal runaway and hazards such as electrical shock, fire, and explosion.



Off-Gassing

Off-gassing is the act of releasing gases from a battery during charging or discharging. Off-gassing at a minor scale can be a normal part of battery operation, but it can accelerate to dangerous levels if the battery is damaged, overcharged, or overheated. These gases can be flammable and toxic. Off-gassing poses an elevated safety risk if it occurs in a confined space, or one that is not properly ventilated.

How Governments Are Reducing E-Bike **Fires with Standards**



Problem:

Ownership of e-bikes and scooters has soared since the pandemic, offering a cost-effective, and environmentally friendly way to get from point A to point B. However, the lithium-ion batteries that power these devices and allow them to be rechargeable have the potential to cause extreme damage if they go into thermal runaway, an uncontrollable, self-heating state that can result in fire or even explosion.

Lithium-ion battery fires are intense, fast, and difficult to extinguish. The Fire Safety Research Institute of UL Research Institutes conducted an e-bike fire test in partnership with the FDNY, finding that it took less than 20 seconds from when the first smoke appeared from the e-bike to completely engulf the room in flames.

Instances of these devastating fires have been reported across the country. They present a unique risk in cities, as more densely populated areas can result in fires that spread quickly from apartment to apartment or building to building.

Solution:

At UL Standards & Engagement, we are working with stakeholders to achieve a safer, more sustainable world through standards. Standards are guidance documents for manufacturing and testing a product's safety, developed by a committee of experts from industry, manufacturing, government, academia, and more.

For e-bikes and scooters. ULSE has three standards that cover the devices and the batteries that power those devices: UL 2849, the standard for e-bikes; UL 2272, for personal e-mobility devices; and UL 2271, the standard for lithium-ion batteries in e-mobility devices. These standards are designed to protect against thermal runaway and the devastating fires it can produce.

How Governments are Handling this Issue

From local to federal government, a variety of approaches are being used to curb deadly lithiumion battery fires. While each solution is unique, leveraging UL standards as part of the solution is common to all of them.

At the City Level

In New York City – where fires more than doubled from 2021 to 2022 and have become the leading cause of deadly fires - the increasing problem required action. The signing of Local Law 39 on March 30, 2023, took a critical step forward in protecting consumers by prohibiting the sale, lease, or rental of e-mobility devices and their batteries that did not meet specific ULSE's safety standards (UL 2849, UL 2272, and UL 2271).

In an effort to remove e-mobility devices that do not conform to safety standards, the city council approved a trade-in program for residents which will allow them to purchase certified products at a lower cost. Additionally, the city approved a separate e-bike tradein program specifically for delivery workers so that they can safely do their job without worrying about a cost burden.

Other cities including Chicago, San Francisco, and Jersey City have followed New York City's example by proactively implementing policy requiring safety standards to protect their communities from sub-standard e-mobility devices. Many other cities have recently introduced legislation. Driving action at the city level is critical to supporting state-wide and eventually federal action.

At the State Level

In 2025, the state of Georgia required all e-mobility devices to be evaluated, tested, and certified to ULSE safety standards. The Office of Insurance and Safety Fire Commissioner used the agency rule making process to amend the state's minimum fire safety standards, illustrating that there is an administrative route to achieving e-mobility safety.





Prioritizing Safety in E-bike Rebate Programs

Atlanta, Boston, Denver, and Washington, D.C. are a handful of several cities that created e-bike programs to make devices more accessible. As the programs were developed, both the city governments took safety into account, including the requirement that e-mobility devices are certified to UL standards.

At the Federal Level

Legislation aimed at reducing the risk of lithium-ion related fires has been reintroduced in the 119th Congress. The Setting Consumer Standards for Lithium-Ion Batteries Act (H.R. 973 and S. 389) would direct the Consumer Product Safety Commission to require all e-mobility batteries be tested to multiple UL safety standards.



Take Action to Drive E-Bike Safety

A few considerations when making a policy decision:

- Evaluate what makes the most sense based on your jurisdiction's unique challenges, including but not limited to number of incidents, e-bike usage, and existing and current infrastructure such as charging networks and availability.
- Look holistically at what should 2 conform to standards. Both the micromobility device and its battery should be tested and certified with an accredited, nationally recognized testing laboratory. At minimum, e-mobility devices should conform to the following:

UL 2849. the Standard for Electrical Systems for e-Bikes

UL 2272, the Standard for **Electrical Systems for** Personal E-Mobility Devices

UL 2271. the Standard for Batteries for Use In Light **Electric Vehicle Applications**

Ensure that the policy covers sales, rentals, and leases of e-bikes and scooters.

The e-bike and scooter market has grown significantly in recent years. As of 2021, commuters and tourists have access to 202,000 micromobility devices across 273 cities. More than 65,000 gig workers rely on e-bikes and scooters to make deliveries in New York City alone.

With this rapid growth has come a rise in the number of battery fires. In 2023, New York City experienced a record number of deaths and fires caused by e-bike batteries. We can and must be smarter about how e-mobility devices are powered, charged, and stored, or fear could give way to bans and restrictions.

A better alternative is creating safer devices that can accommodate the strong demand for e-bikes and scooters that are popular among tourists and commuters, and a means of livelihood for delivery workers.

The existence of a growing market does not negate the existence of the problem.

UL Standards & Engagement has more than 80 standards focused on reducing the risk of lithium-ion battery-related fires. As lawmakers consider the transition to cleaner energy, safety must be a priority. This is true for every component of micromobility, from battery to charging to use.



The Rising Threat: The Alarming Surge and Cost of E-Mobility Battery Fires in New York City



Key Findings



The number of e-mobility battery fires in NYC increased nearly 800% from 2019-2023. In 2019, there were 21 e-mobility battery fires; in 2023, that figure dramatically increased to 187.



damage.

E-mobility has transformed urban transportation in New York City, but uncertified devices and inadequate public safety awareness have led to a sharp increase in e-mobility related battery fires. The frequency and severity of these fires have threatened public safety and are associated with widespread disruptions and economic losses.

To further understand the implications of these fires, UL Standards & Engagement and Oxford Economics collaborated to conduct an analysis guantifying the economic, human, & community toll.



E-mobility fires cost NYC \$518.6 million in damage and loss from 2019 to 2023

E-mobility fires cost NYC \$518.6 million in damage and loss from 2019 to 2023, with approximately \$257.9 million in fatalities, \$220.7 million in injuries, and an estimated \$40 million in structural property



New York City e-mobility owners report unsafe practices that raise risk. Of those who typically charge their e-bikes at home, 66% do so in a location blocking their exit. Nearly one-third (32%) of owners routinely charge overnight, and nearly one-in-five (17%) charge them unattended while away from home.

Perceptions of E-mobility Battery Safety

Lithium-ion batteries are widely used by e-bike and e-scooter manufacturers but these batteries can present safety hazards to owners if damaged, improperly charged, poorly manufactured, or counterfeit. Educating consumers about safety hazards and associated risks such as thermal runaway are paramount to ensuring the safe future of electric micromobility.

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E-mobility devices are critical to the work lives of urban residents



45% of riders are in urban areas

54%

of owners purchased e-bikes or e-scooters for work, 72% have used it for delivery gigs in the past 12 months



of riders are low income and 32% are middle income



Battery replacement practices bring concerning safety variables

Nearly half of e-bike owners (48%) have replaced their old e-bike battery. Many did so as a result of circumstances that threaten safety:

11%

caught on fire

were overheating

24%

were swelling

or bulging

16% damaged from a crash or collision

(03) Lack of awareness translates to behaviors that increase fire risk



Nearly half of riders who charge at home are blocking their home's fire exits, a contributing factor in several cases where death occurred.

It takes only 20 seconds from the first sign of smoke to a room being engulfed in flames from a lithium-ion battery. A traditional fire typically takes about three minutes, according to tests conducted by Fire Safety Research Institute.

There is little awareness of the power source or its risk

The majority of owners of these devices are unaware that their devices are powered by a lithium-ion battery.

e-bike

(04)

53% unaware e-scooter 54% unaware

E-mobility Fires Can Be Devastating. They Don't Have To Be.

The e-mobility market has grown dramatically, reducing cars on the road, supporting workers in the gig economy, and helping cities meet sustainability goals. Preserving the e-bike and e-scooter market means protecting against the fire risk these devices carry.

Take Action

Safety standards help protect Americans from deadly battery fires and other safety risks, while preserving access to the e-bikes and e-scooters consumers want. Learn how you can support the adoption of e-mobility safety standards.



Design policy proposals to help reduce fires caused by batteries in e-mobility devices.

Read our letter of support for the passage of H.R.973.



Read our letter of support for the passage of S.389.



Stay up-to-date with the latest news and resources.

Read Our Report

Learn more about critical consumer knowledge gaps among e-bike, e-scooter, and other e-mobility device users. Our latest report provides an in-depth look at key trends in e-mobility safety.

Visit ebikesafety.ulse.org to learn more

Awareness Gaps Increase Fire Risks

E-mobility devices are commonly powered by rechargeable lithium-ion batteries. But if damaged, malfunctioning, modified, counterfeit, or otherwise substandard, these batteries can enter thermal runaway, an uncontrollable, self-heating state that can lead to smoke, fire, toxic off-gassing, or explosion. Most riders, however, are unaware of their device's power source or its risks — or that there are safety standards that exist to protect them.





Charging and Energy Storage and Distribution

- 7 Electric Vehicle Supply Equipment | UL 2594
- 8 Charging System Equipment | UL 2202
- 9 Plugs, Receptacles and Couplers | UL 2251
- Protection Devices in Charging SystemsUL 2231-1, UL 2231-2
- 11 Energy Storage Systems | UL 9540

Test Methods for Evaluating Thermal Runaway Fire Propagation in Battery ESS | UL 9540A

12 Energy Management Equipment | UL 916

E-Mobility Standards

UL 2849: Electrical Systems for e-Bikes

- Lists construction and performance requirements to evaluate the electrical systems of e-bikes such as the drive unit, battery, battery management system, wiring, power inlet, dedicated chargers, to reduce the risk of fire, injury to persons, and mechanical and electrical hazards
- Testing simulates conditions an e-bike may encounter in normal use, such as high temperatures in a garage or storage unit, water exposure from light rain or splashing puddles, and vibration from riding on an uneven road. Some of the tests take into account abnormal use such as a locked rotor condition of the motor and foreseeable misuse as well like overloading the motor
- Requires manufacturers to include cautionary markings on e-bikes, and instructions in e-bike packaging to ensure users are informed on proper charging, operation, maintenance, moving, and storage practices for the eBike and its battery
- An e-bike will not pass required testing if it exceeds certain temperature limits, or if there is any indication of fire, explosion, rupture of the enclosure/casing, electrolyte leakage from the battery, or electric shock hazard



UL 2271: Batteries for Use in Light Electric Vehicle (LEV) Applications

- Covers electrical energy storage assemblies such as battery packs and combination battery pack-electrochemical capacitor assemblies and the subassembly/modules that make up these assemblies for use in light electric-powered vehicles
- Also covers battery management systems that provide protection and control for the EESAs
- This standard covers the battery systems for use in light electric vehicles such as electric bicycles, electric scooters, electric wheelchairs, golf carts, all-terrain vehicles, non-ride-on industrial material handling equipment, unmanned aerial vehicles, ride-on floor care machines, and personal e-mobility devices
- Testing simulates normal use, abnormal use, and foreseeable misuse of the battery system, such as mechanical shock from being dropped by a user, or overcharging of the battery due to a fault in the charging control circuitry
- An EESA, battery, or battery assembly will not pass required testing if it exceeds certain limits, or if there is any indication of fire, explosion, rupture of the enclosure/casing, electrolyte leakage from the battery, venting of the battery, loss of protection controls, or electric shock hazard

UL 2272: Electrical Systems for Personal E-Mobility Devices

- Addresses hazards from the batteries and electrical systems for personal e-mobility devices such as hoverboards or e-scooters
- Testing simulates normal use, abnormal use, and foreseeable misuse, such as mechanical shock from being dropped by a user, or overcharging due to a fault in the charging control circuitry
- A device will not pass required testing if it exceeds certain limits, or if there is any indication of fire, explosion, rupture of the enclosure/casing, electrolyte leakage from the battery, or electric shock hazard

UL Standards & Engagement: 120 years in standards development

UL Standards & Engagement is a nonprofit standards development and advocacy organization that translates safety science into practical, action-oriented standards, from toasters to life jackets, and lithium-ion batteries to solar power.

The organization also serves as a vital resource for policymakers and shares knowledge, advances partnerships, and advocates for standards and policies to create a safer, more sustainable world.

What is safety science?

Safety science engages the ingenuity of top minds across scientific fields to engineer a safer and more sustainable world in which every individual can thrive.

What is a standard?

A standard is a document of best practices for manufacturing and testing the safety, security, and sustainability of a product or system, developed and voted on by experts across industries and interests.

How are standards developed?

UL Standards & Engagement convenes technical committees comprised of experts from manufacturing, government, academia, nonprofits, and other relevant groups to develop and maintain our standards. Technical committee members review proposals for new or revised standards and work together to achieve consensus through balloting in a fair and transparent process. Learn more about the standards development process at ULSE.org/about/learn.

What happens after a standard is published?

All ULSE standards are free to view with site registration at shopULstandards.com. Manufacturers and innovators can develop products, which can then be tested and certified that they conform to our standards to ensure they are as safe as possible. UL Standards & Engagement is continuously monitoring and revising standards to address a changing risk landscape and emerging technologies.



Fast Facts:



1,700+ standards and documents in use today



4,000+ individuals serve on ULSE technical committees



40+ countries are represented through our technical committees



80+ MOUs with agreements in several countries and regions



ULSE is the only standards organization accredited in the U.S. and Canada and authorized in Mexico

