

Enhancing Consumer Trust and Innovation in Smart Homes Through Standards





Standards and certifications play distinct yet complementary roles in the smart home space. Standards establish foundational guidelines for smart home product safety, reliability, and interoperability, while certifications verify compliance through rigorous testing and assessment. UL Standards & Engagement conducted research that reveals how this framework of standards development and subsequent certification builds consumer trust and fosters business innovation.

Nine in ten consumer technology executives view adherence to standards and achieving certifications as drivers of innovation in the smart home sector.

Certifications also resonate with consumers — nearly half of U.S. consumers recognize certification marks as indicators of safety and quality. These findings emerge from a comprehensive study combining surveys conducted in November 2024 of 2,021 U.S. consumers and 176 consumer technology industry leaders.

Three fundamental safety imperatives — electrical and fire safety, data security and privacy, and product reliability — have made certification essential for both innovation and market success. Majority of smart home device owners value verified safety and are willing to pay more for certified models, particularly for safety-critical products such as connected water leak detectors and smart carbon monoxide and smoke detectors.

The business implications extend beyond compliance. Companies effectively integrating product certifications into their innovation strategies can secure significant market advantages. Moreover, companies that obtain multiple types of certifications (such as safety, performance, and environmental) report compounding benefits, with more than two-thirds report achieving additional market support.

Market response to certifications varies by segment. When considering smart home purchases, early adopter consumers are much more likely to actively seek out and verify product certification status. Meanwhile, companies approach certification strategy based on size: large enterprises integrate standards deeply into research and development, while mid-sized firms demonstrate agility, with three-quarters taking a fully embedded or proactive approach to certification.

These findings point to the evolving role of standards in smart home innovation. Industry leaders must now align compliance strategies to standards with technological

advancement, particularly as environmental and safety certifications reshape consumer expectations and product development. In addition to certification trends, this report showcases several ULSE standards designed to mitigate critical safety, security, and sustainability issues in smart home products.

As part of a special release at CES 2025, this report also highlights a range of standards on connected devices, cybersecurity, AI-driven products, and energy efficiency that are managed by the Consumer Technology Association (CTA)[®], owner and producer of CES[®], the world's most powerful tech event.

Key Takeaways

1 Standards build market trust and growth in the smart home sector

- Certifications influence both consumer trust and business innovation. Certification marks and labels (32%) indicating compliance to standards now match consumer trust ratings for traditional indicators like brand reputation (32%) and expert reviews (29%).
- Nine in ten (92%) senior executives believe that following industry standards and obtaining certifications helps their companies innovate more effectively, and organizations prioritizing certification report significant market advantages.

2 Standards create a foundation for innovation while maintaining trust

- Companies can gain measurable advantages by certifying their products to industry standards, with 44% reporting competitive and innovation benefits. Product certifications serve as both an innovation catalyst and trust signal — 69% of consumers express greater confidence in certified products, enabling faster market adoption of new features.
- Market response reinforces this approach: 77% of companies report earning pricing premiums with products certified to standards, and 69% achieve additional advantages through multiple certifications.

3 Consumer adoption patterns and device categories drive standards impact

- Certification importance varies both by who is buying (early adopter vs. mainstream) and what they're buying (safety-critical vs. other devices). Early technology adopters demonstrate the strongest interest in certification, with 32% willing to pay more for certified products compared to mainstream (17%) and late adopters (16%).
- The importance of specific certifications varies markedly by device category, especially for products that are safety-critical devices. In a direct comparison of safety vs. environmental considerations, safety certifications (38%) outweigh environmental (26%) ones in CO/smoke detectors adoption. Meanwhile the opposite is true for smart appliances (32% for environmental vs. 29% for safety).
- These category-specific patterns are reinforced by certification awareness levels, which peak for safety-critical devices such as connected sensors (61%) and smart locks (57%).




Two-thirds (67%) of smart home device owners are willing to invest in products certified to comply with standards



Standards Protect Consumers and Foster Innovation

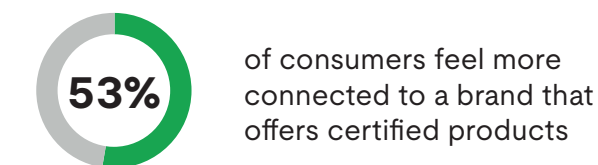
Smart Home Certifications Explored in the Study:

 Safety certifications (e.g., UL, ETL/Intertek)	<p>Safety certifications ensure that devices meet strict voluntary consensus safety standards, such as those that address electrical and fire safety. These are typically critical baseline requirements that protect consumers and reduce liability for manufacturers.</p>
 Protocol interoperability certifications (e.g., Matter, Zigbee, Thread)	<p>Certifications, such as Matter or Thread, ensure devices can seamlessly communicate with each other across platforms and ecosystems. In smart homes, interoperability reduces fragmentation, enabling devices from different manufacturers to work together effectively.</p>
 Platform certifications (e.g., Works with Alexa, Apple HomeKit)	<p>Platform certifications validate that devices work properly with major smart home platforms and voice assistants, giving consumers confidence in compatibility and simplified setup with their preferred ecosystems.</p>
 Performance certifications (e.g., IP ratings, ISO)	<p>Certifications like IP ratings for water/dust resistance and ISO standards verify that devices meet specific functional requirements and quality benchmarks, helping consumers choose products that will reliably serve their intended use cases.</p>
 Environmental certifications (e.g., ENERGY STAR, RoHS)	<p>These certifications demonstrate compliance with energy efficiency standards and restrictions on hazardous materials, which is increasingly important as consumers and regulators focus on sustainability and environmental impact.</p>
 Self-declared conformity and standards compliance	<p>A manufacturer's own declaration that its product meets certain standards, without third-party verification. While faster and cheaper than formal certification, it provides less assurance to consumers and may have limited acceptance in regulated markets.</p>

Safety standards do more than help ensure compliance — they act as catalysts for innovation and maintain consumer protection. Certifications demonstrate compliance to standards, which outline minimum guidelines or specifications and drive enhanced safety features, with both consumers and businesses recognizing their dual role in protection and development.

Growing Trust: Certifications on Par with Brand Reputation & Expert Reviews

Certification marks achieve trust ratings similar to traditional indicators: a third (32%) of smart home device owners said they completely trust certification marks, comparable to those who said they trust brand reputation (32%) and expert reviews (29%) when evaluating smart home products. These findings align with business leaders' perspectives — 44% of executives say the primary benefit their organization has realized from product certifications is customer trust and enhanced brand reputation. Another 44% of companies surveyed say that certifying products to standards gives them a competitive and innovation advantage over peers, and 34% say it has given them greater market access, including retail channels.



Enhancing Loyalty Through Standards

Certification to standards builds a foundation of trust for smart home device owners. This foundation of trust shapes consumer behavior in two key ways: consumers become more loyal to brands that offer certified products and are more understanding when minor product issues occur. As a result, consumers feel more connected to a brand that offers certified products (53%) and are more likely to buy from the same brand again (66%).

Trusted Standards Create Pathway for Faster Market Adoption

Certification serves a dual purpose in the marketplace: it acts as a catalyst for innovation while its visible marks on products serve as powerful trust signals to consumers. Smart home devices with certifications see higher consumer acceptance of new features, with 69% of consumers reporting increased brand trust for certified products. Business leaders confirm this opinion — 70% of companies track certification ROI through improved customer satisfaction and 68% through improved brand value. The link between certification and consumer acceptance creates a framework for faster market adoption of new technologies.

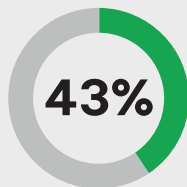


Navigating Customer-Brand Relationships With Certification



Understanding where and how certification drives value requires a segmented view of the smart home market. Our analysis reveals variations in consumer willingness-to-invest and business outcomes, with three critical dimensions that determine certification impact: consumer adoption profiles, device categories, and brand relationships.

 **32%**
of early technology adopters are willing to pay more for certified products

 **43%**
of companies consider certifications during early concept and design phases

Early Adopter Consumers Demonstrate Stronger Preference for Certified Products

Early technology adopters attach distinct value to certification: 32% are willing to pay more for certified products (versus 17% for mainstream, 16% for late adopters), and they show stronger verification intentions with 41% saying they will "definitely" verify certifications for future purchases (compared to 31% mainstream users). Their certification preferences also differ, with early adopters showing higher interest in environmental certifications (32%) compared to mainstream (24%) and late adopters (20%). This elevated engagement appears consistent across the consumer decision journey, from initial research through post-purchase behavior.

Smart Home Device Category Influences Consumer Value and Prioritization

Market opportunity varies significantly by device category. Consumer willingness to pay more for certification is strongest for safety-critical device adoption such as smart smoke/CO detectors, connected home safety sensors (e.g., water leak detectors), and certified smart locks. When asked to directly compare environmental certifications against safety certifications, priorities vary by device category. For smart CO/smoke detectors, safety certifications are relatively more important (38% vs. 26%), while environmental certifications are slightly more important (32%) than safety (29%) for smart appliances.

Standards Offer Companies Foundation and Room to Innovate

Three patterns demonstrate how companies build on standards: First, certification requirements completely or significantly influence R&D priorities for 85% of smart home technology firms. Second, companies integrate standards systematically – 71% of smart home technology companies have advanced approaches, with 32% using proactive certification strategies and 38% having fully embedded or integrated certification in development. Finally, over 43% consider certifications during early concept and design phases, enabling innovation from the start of product development.

At a Glance: Standards Impact on Smart Home Tech

Data Source:

When purchasing each of the following types of products, which certification type is MOST important to you?

Device Category	Overall Certification Importance	Safety Importance	Environmental Importance	Cybersecurity & Privacy Importance
Smart Smoke/CO Detectors	94%	50%	9%	9%
Smart Appliances	92%	47%	16%	9%
Connected Air Quality Monitors	91%	36%	21%	19%
Smart Locks/Garage Door Openers	90%	38%	12%	21%
Smart Security Systems	90%	35%	6%	27%
Smart Thermostats or Climate Control	90%	41%	16%	12%
Connected Home Safety Sensors	89%	35%	16%	16%
Smart Lighting Systems	88%	41%	11%	10%
Smart Speakers / Virtual Assistants	85%	28%	8%	25%

Lower Importance (0%)

Higher Importance (100%)

- **Overall Certification Importance:** % respondents selecting ANY type of certification (i.e., safety, environmental, performance, cybersecurity, privacy)
- **Safety Importance:** % respondents selecting "Safety certifications that ensure products won't cause physical harm, like electrical safety or fire prevention"
- **Environmental Importance:** % respondents selecting

"Environmental certifications that show products are eco-friendly, like energy efficiency ratings"

• **Cybersecurity & Privacy Importance:** % respondents selecting "Cybersecurity certifications that confirm protection against hacking and digital attacks" or "Privacy certifications that ensure your personal data is protected and properly handled"

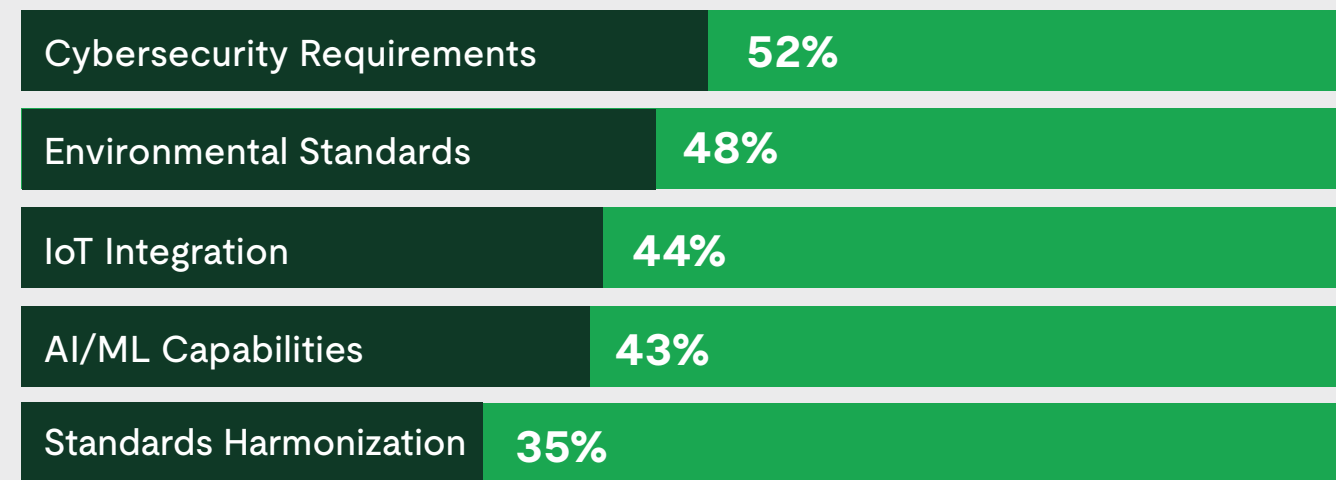
Based on survey data of 1,200 U.S. smart home device owners

Future Outlook and Recommendations



Forward-looking executives anticipate a shifting standards and certification landscape that will significantly affect product development and innovation. The overall sentiment is notably optimistic, with 79% of industry leaders expecting product certifications to accelerate innovation over the next three to five years.

When asked about anticipated trends, the top certification priorities are:



68%

of consumers plan to consider certification status in their future smart home purchases

1 Align certification investments with device risk profiles

Consumer awareness of certification correlates directly with perceived device risk — 61% for safety sensors and 57% for smart locks, compared to lower awareness for non-safety-critical devices. Smart home technology companies recognize this, with 85% saying certification requirements significantly influence their R&D priorities.

2 Position standards compliance as driver for brand reputation

Smart home devices with certifications see higher consumer acceptance, with 69% of consumers reporting increased brand trust for certified products. This trust translates to market differentiation — 70% of companies track the ROI of certification through improved customer satisfaction, reflecting enhanced user experiences and loyalty, while 68% link it to increased brand value, demonstrating the role of certification in strengthening reputation and competitive positioning in the market.

3 Integrate standards compliance throughout development

Certification marks now rival traditional indicators of trust like brand reputation and expert reviews. Companies that design to standards from the outset build both certification credentials and brand equity more effectively, with 43% considering safety certifications during early concept and design phases.

4 Implement comprehensive certification strategies that address safety fundamentals and emerging requirements

Meeting safety standards helps achieve necessary certifications and compliance, creating a foundation for both current and future needs. Companies recognize this strategic necessity, with 43% identifying AI/ML capabilities as essential for maintaining safety and quality in evolving technology. This structured approach addresses market expectations, as more than two-thirds (68%) of consumers plan to consider certification status in their future smart home purchases.

69%

of consumers report increased brand trust for certified products

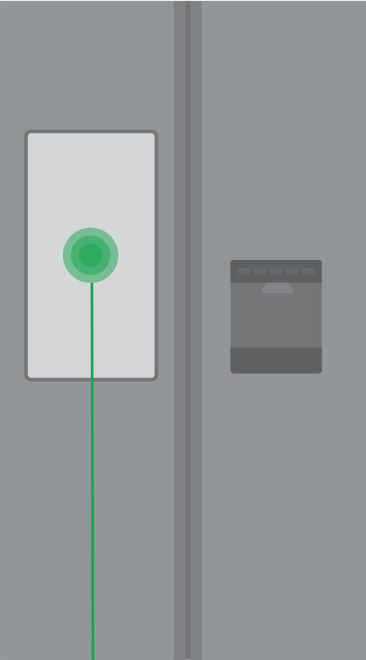


Advancing Innovation Through Standards



Smart Smoke or CO detectors

UL 2900-2-3, the UL Outline of Investigation for Software Cybersecurity for Network-Connectable Products, Part 2-3: Particular Requirements for Security and Life Safety Signaling Systems



Smart Appliances

UL 1499, Recommended Practice for Implementing Software Updates to Appliances

Renewable Energy

UL 6142, Small Wind Turbine Systems

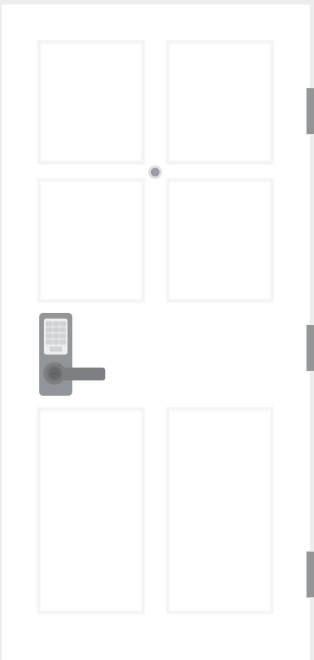


Smart Security Systems

UL 5500, Standard for Safety for Remote Software Updates

Smart Speakers or Virtual Assistants

CTA 2096, Guidelines for Developing Trustworthy Artificial Intelligence Systems



Energy-Efficient Homes

CTA-2045-B, Modular Communications Interface for Energy Management

Smart Thermostats or Climate Control

CTA 2088-A, Baseline Cybersecurity Standard for Devices and Device Systems



Smart Network

CTA-2049-B, Determination of Small Network Equipment Energy Consumption



Advancing Innovation Through Standards

UL Standards & Engagement and the Consumer Technology Association develop standards that guide technological progress across smart homes, artificial intelligence, cybersecurity, sustainable energy, and more.

The development of voluntary consensus safety standards represents a collaborative effort across industries, bringing together diverse expertise to establish trusted guidelines. These standards emerge through a transparent process where manufacturers, testing laboratories, academic researchers, government agencies, and consumer advocates work together to define best practices. What makes these standards particularly robust is their foundation in consensus-building – each standard must achieve substantial agreement among participating stakeholders before publication. This rigorous approach ensures standards reflect both current technical capabilities and market needs, while incorporating critical safety considerations from multiple perspectives.

From medical devices to consumer electronics, these standards enable manufacturers to create safer products while building trust and instilling confidence in consumers' technology choices. Taken together, standards form a framework that protects public safety and fosters innovation everywhere – from connected health devices to climate resilience.

Learn more about a selection of ULSE and CTA standards that, along with many others, are shaping the future of smart home technology.



IoT, Smart Home Technologies, and Automation Systems:

- UL 1499, Recommended Practice for Implementing Software Updates to Appliances, guides manufacturers in safely updating smart home appliances.
- UL 5500, Standard for Safety for Remote Software Updates, establishes requirements for secure remote updates, protecting user privacy through measures like cryptographic techniques.



AI-driven Products:

- CTA 2096, Guidelines for Developing Trustworthy Artificial Intelligence Systems, helps organizations create reliable AI systems. This standard outlines principles for trustworthy AI and provides a clear method for companies to report how their AI applications adhere to these principles.



Cybersecurity for Connected Devices:

- CTA 2088-A, Baseline Cybersecurity Standard for Devices and Device Systems, establishes essential security requirements for all connected consumer devices, from thermostats to smart TVs.
- CTA-2120, Design Requirements for a Label for IoT Device Cybersecurity (forthcoming), will create a standardized cybersecurity label consistent with the U.S. national label program.
- UL 2900-1/UL 2900-2-3. UL 2900 is a series of cybersecurity standards developed by ULSE to address the security of software and network-connectable products. UL 2900-2-3 addresses requirements for Security and Life Safety Signaling Systems such as smoke and CO detection devices as well as smart locks.



Sustainable and Energy-Efficient Homes:

- UL 3741, Photovoltaic Hazard Control, and UL 6142, Small Wind Turbine Systems. ULSE standards guide the development of sustainable energy technology, as well as the systems necessary for safe distribution, transmission, and energy storage. UL 3741, and UL 6142, are among more than 20 UL standards that make wind and solar power safer and more accessible for homes and communities.
 - 17 ULSE standards for fuel-handling equipment were recently updated to help facilitate a safe transition away from fossil fuel reliance in the U.S. and Canada – providing requirements that ensure existing pumps and tanks are compatible with renewable content in biofuels.
 - UL 9540, Standard for Energy Storage Systems and Equipment, is designed to address energy storage systems in a variety of applications, including residential, commercial, and utility-scale settings.
 - UL 61703, Standard for Flat-Plate Photovoltaic (PV) Modules and Panels, aligns with international norms for solar panel safety, specifically IEC 61730, to evaluate PV modules for safety in terms of electrical, mechanical, thermal, and fire risks.
- Several CTA standards work together to measure and improve the energy efficiency of common household electronics:
- CTA-2045-B, Modular Communications Interface for Energy Management, standardizes a universal socket and protocol that appliances can use to connect with power grids through plug-in modules. This allows utilities to incentivize reduced energy use during peak times, while consumers retain choice in their home networking technology.
 - CTA-2049-B, Determination of Small Network Equipment Energy Consumption,

establishes testing procedures for measuring energy use of modems and routers while in ready state, supporting programs like ENERGY STAR.

- CTA-2043-B, Set-top Box Power Measurement, provides standardized methods for measuring power consumption in cable boxes.
- CTA-2037-D, Determination of Television Set Power Consumption, defines methods for measuring TV power use and brightness for externally powered indoor televisions.
- CTA-2084-A, Test Methods for Determining A/V Product Energy Efficiency, establishes procedures for measuring energy performance across various audio/video products, from soundbars to smart speakers.



Climate Resilience:

ULSE standards for the built environment help communities adapt to future impacts of climate change such as extreme heat, increased severe weather events, and rising sea levels.

- UL 1897, Uplift Tests for Roof Covering Systems, and UL 2218, Impact Resistance of Prepared Roof Covering Materials, are among several standards that help ensure household rooftops can resist uplift and damage caused by flying debris in heavy winds.
- UL 263, Fire Test of Building Construction and Materials, is one of three UL standards referenced in the 2021 International Wildland-Urban Interface Code and State of California Building Code that help evaluate building materials in areas at risk for wildfire exposure.
- To date, **22 ULSE standards** have been updated to include requirements that improve the durability of building materials and public infrastructure against environmental conditions including, but not limited to, extreme snow loads, wind force, flooding, temperatures, & UV exposure.

Research Methodology



These results were taken from two separate UL Standards & Engagement Insights surveys to provide a comprehensive view of how safety standards influence both consumer behavior and business innovation in the smart home sector. All studies were designed and formulated by UL Standards & Engagement.

Surveys were administered online by BV Insights. As a member of the Insights Association and ESOMAR (the European Society for Opinion and Marketing Research), BV Insights adheres to industry ethics and best practices, including maintaining the anonymity of respondents.

Consumer Study

- n=2,021 U.S. adults, conducted between November 13-21, 2024
- Sub-quotas were set to divide the overall sample by n=1,200 smart home device owners vs. n=800 non-owners.
- Smart home devices used for qualification: Smart security systems (e.g., cameras, doorbell, motion sensors), Smart thermostats or climate control, Smart smoke / CO detectors, Smart lighting systems, Smart locks / smart garage door openers, Smart appliances (e.g., refrigerator, washer, etc.), Connected home safety sensors (e.g., water leak detectors), Smart speakers/virtual assistants (e.g., Google Home, Amazon Echo), Connected air quality monitors
- 2023 annual household income: 62% <\$50K, 27% \$50-\$100K, 11% \$100K+
- 13% Early Adopter (i.e., "I am usually one of the first people to try new technologies")

The margin of sampling error for the consumer study, at 95% confidence for aggregate results, is +/- 2.2%. Sampling error is larger for subgroups of the data.

Business Executive Study

- n=176 executives Director-level or higher, conducted between November 14-26, 2024
- 19% Founders or C-Level employees
- Average 9.8 years of experience in senior roles related to product development, innovation, or regulatory affairs
- Primary industry: 19% Smart Home Technology Products, 14% IoT Products, 64% Consumer Electronics, 3% Industrial IoT Products
- 30% Less than 50 employees, 40% 50-500 employees, 30% More than 500 employees
- 63% always consulted or directly involved in decisions regarding product certifications
- 68% final decision-maker in certification-related decisions within organization

The margin of sampling error for the business executive study, at 95% confidence for aggregate results, is +/- 7.3%. Sampling error is larger for subgroups of the data.

As with any survey, sampling error is only one source of possible error. While non-sampling error cannot be accurately calculated, precautionary steps were taken in all phases of the survey design and the collection and processing of the data to minimize its influence.

Note: All numbers are percentages unless otherwise noted. Figures may not total 100% due to rounding.



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.



About Consumer Technology Association (CTA)[®]:

As North America's largest technology trade association, CTA is the tech sector. Our members are the world's leading innovators – from startups to global brands – helping support more than 18 million American jobs. CTA owns and produces CES[®] – the most powerful tech event in the world. Find us at [CTA.tech](https://cta.tech). Follow us @CTAtech.

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 organization accredited in the U.S. and Canada, and authorized in Mexico



