



The Next Wave: Opportunities for Connected Devices



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Are you ready for the next wave of connected device opportunity?

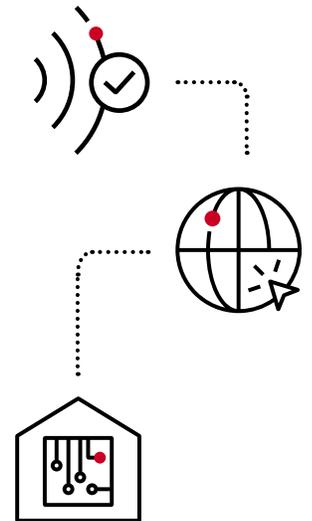
Manufacturers and designers who get ahead of these three smart home and building trends will be well-positioned to secure market preference.

[Amara's Law](#)ⁱ tells us that we tend to overestimate the effect of technology in the short run while underestimating it in the long. That's certainly been the case in the Internet of Things (IoT) space.

Before 5G's marketing boom, you may recall that IoT services generated a tremendous amount of buzz. While the technology doesn't command the same public attention today as it once did, adoption has continued. Of course, IoT's place on the Gartner Hype Cycle is driven, in part, by industry and application.

[Industrial and B2B segments proved essential in fueling IoT's post-2017 resurgence](#)ⁱⁱ. From micromobility and energy production to methane monitoring and HVAC, companies are leveraging IoT to operate more safely, efficiently and sustainably.

Meanwhile, many categories within consumer IoT are approaching Gartner's Plateau of Productivity. In new building construction and home renovation, for example, a smart thermostat is now the obvious choice. That said, space for innovation still remains, especially for those who are looking ahead and seizing opportunities to optimize performance and simplify user experience.



What does this maturing market mean for you?

Today, buyers are no longer satisfied by features alone. Carving out market share is now primarily about differentiation and heightened standards.



Still, in this maturing market, there's plenty of opportunity for those who address buyer concerns and nurture market preference. In fact, [the number of connected devices worldwide is expected to grow to 125 billion by 2030ⁱⁱⁱ](#).

[Pre-2019 work-from-home and hybrid work models played instrumental roles in driving smart home demand, and COVID-19 has accelerated this trend^{iv}](#). Today, people working from home offices want connected devices that deliver more comfort, convenience and security.

Employees working from home simultaneously puts pressure on the smart building space and creates fresh opportunities. [Organizations want to draw people back to the office and are trying to deliver the comfort and convenience employees demand^v](#). Additionally, they're feeling the downward pressure of physical spaces that see less use. Now, they're absorbing building maintenance and security costs as well as work-from-home costs.

As the consumer and enterprise-connected device markets grow, it's critical for designers and manufacturers to recognize that those markets are also becoming more sensitive. [Concern for the climate and the environment is on the rise^{vi}](#) and [consumers are increasingly purchasing smart home products that align with their values^{vii}](#). Likewise, organizations are looking for smart building products to help them meet their sustainability commitments — commitments that are increasingly important to both buyers and employees.

Forward-thinking designers and manufacturers who launch secure and reliable connected devices while also demonstrating their commitment to sustainable, responsible manufacturing will be well-positioned to seize this growing market opportunity.

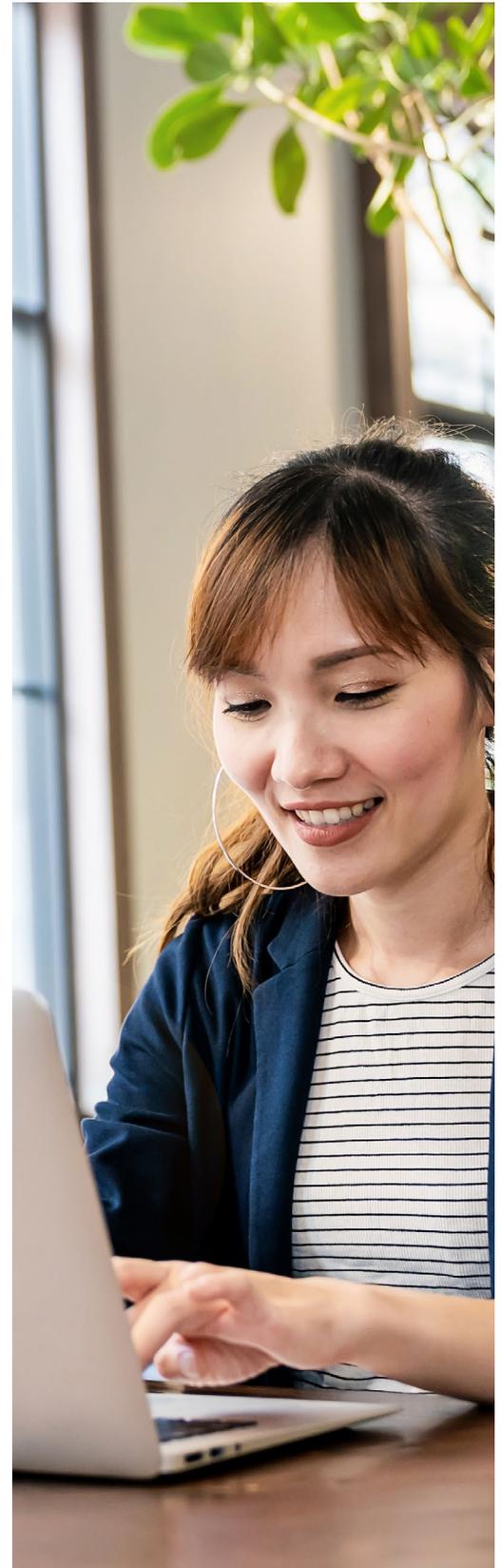
Here's what you should be thinking about

Environmental, social and governance (ESG): Your commitment to sustainability will attract values-driven buyers

[Increasingly, buyers are making purchasing decisions based on concern for manufacturing's impact on the climate and environment^{viii}](#).

How do connected device designers and manufacturers deliver against their sustainable manufacturing expectations? They do it through ESG.

Some have understandably questioned the ESG framework, and it's important to acknowledge that it's experiencing some growing pains. That said, ESG is ultimately inevitable. If we think back to the dot com bubble, there was unchecked speculation and early, bullish investment. Some portfolios didn't perform well, and those early missteps led to overcorrection. The predictions were right, however; it just took a few more years to realize growth.



Similarly, companies that find success in the future will adapt themselves to the ESG risk landscape all around us. We may be lagging behind some overly aggressive market expectations, but leveraging ESG to secure market preference — and even charge a premium price — is only a matter of time. In fact, [54% of consumers today say they're willing to pay more for sustainable, environmentally responsible brands](#)^{ix}.

Delivering on buyer expectations, however, has become far more challenging. Today, brands face unprecedented scrutiny amid rising complexity. Regulations are increasing, and Europe — and California, to a degree — are increasingly placing the responsibility for sustainable supply chains on end manufacturers. At the same time, [non-governmental organizations \(NGOs\) are influencing buyer preferences, consumers are making green purchasing decisions](#)^{xi} and powerful brands are issuing nonregulatory requirements in support of their own sustainability commitments.

Connected device designers and manufacturers are no longer competing with the market as it is today, but rather the more sustainable, responsible market of tomorrow — a market that is simply inevitable. Those who are more prescient and more predictive will benefit from this evolving market opportunity.

Frameworks like the [Task Force on Climate-related Financial Disclosures \(TCFD\)](#)^{xii} now drive this mindset. They're asking companies to explore forward-looking risks. Is your factory likely to flood? What legal, financial and consumer evolutions will impact your company?

While companies are beginning to recognize the importance of this trend, many are still looking through a very narrow carbon lens. Truly forward-thinking companies will pull back and look at the many other dimensions of ESG as well.

Where are we today, and where are we headed?

It helps to consider company growth across the ESG life cycle — emerging, evolving and leading.^{xiii}

ESG emerging

Companies in this stage know that they need to measure ESG; they're getting clear guidance on what to measure and starting to access measurement tools. Still, they're ultimately using ESG for compliance purposes.

In short, these companies are designing connected products without an intentional set of design concepts for ESG. They may produce inherently single-use parts from conventional materials at the lowest cost available but overlook poor factory working conditions. In the absence of direct ESG interventions, these ESG-emerging companies will typically invest in small-scale compensatory or philanthropic initiatives.





ESG evolving

Evolving companies are taking decision-useful data and folding it into the models they deploy, the products they innovate and the way they run their businesses. They're starting to think about how they can use this data to build products that use more sustainable materials, are more energy-efficient and have geography- or jurisdiction-relevant recycling pathways. They've got the window dressing, but they also have some ESG products they can start selling in the market.

ESG leading

Leading businesses are reorganizing for ESG performance. They're taking ESG-relevant data and pushing it to the right people at the right time and with the right incentives to act for ESG. In essence, they're baking ESG into their organizations through their culture, incentives and guiding principles.

What catalysts will accelerate companies in this direction?

Data, predictive analytics, remote sensing and a range of other interesting technologies will all be part of the toolkit necessary to reach ESG maturity. Maturity will also demand a more holistic, behavioral approach. Companies must rethink everything they do to align people, processes and incentives to change behaviors and outcomes.

When companies move in this direction, you'll see them start to pass on the costs of mandates and evolving customer expectations to the buyer, which can create more sustainable profits. This will be forced on some, like those operating within the scope of emissions trading schemes, and they'll pay a cost per ton of carbon emitted. Whether required or voluntary, however, these businesses are beginning to rethink their organization; they're redesigning in a way that minimizes their exposure.

[Novo Nordisk is a great example of an organization moving toward maturity](#)^{xiv}. They voluntarily price externalities into the decisions they make so they optimize their growth plans not only for profit, but to accommodate how price externalities could impact that profit, as well. That means they might choose a model that's more expensive today because it will be more resilient in a future that taxes carbon or plastic.

This shadow pricing is well-understood on the carbon side. Could plastic be next on the production line?

The [CDP, formerly the Carbon Disclosure Project, has recently expanded its annual reporting to account for plastic pollution^{xv}](#), signaling that investors consider it financially material, and companies can now [purchase plastic credits to offset their impact^{xvi}](#).

Connected device designers and manufacturers like you would be wise to look to Extended Producer Responsibility (EPR) schemes and plastic taxes in the EU and begin factoring these price signals into your packaging strategies.

Have there been a few missteps in the ESG space? Yes.

[The markedly different methodologies leveraged by ESG rating agencies have resulted in contradictory scores, creating confusion among investors and undercutting confidence in ESG to drive sustainable practices^{xvii}](#). In fact, [an MIT study revealed that the correlation across six leading rating agencies was just 61%^{xviii}](#).

[We're also seeing the emergence of anti-ESG legislation in some regions of the United States^{xix}](#). While not insignificant, this is just one jurisdiction of many. Examples of the growing global trend toward pro-ESG policy can be found in the [EU Corporate Sustainability Reporting Directive \(CSRD\) adopted in November 2022^{xx}](#) and the [ESG schemes coming out of Southeast Asia^{xxi}](#). What's more, some U.S. companies like [BlackRock are strengthening their commitment to an ESG focus despite facing anti-ESG rhetoric^{xxii}](#).

Corporations see the opportunity of ESG. In a recent survey, 52% reported that it enabled them to reduce both waste and costs while also boosting corporate reputation and brand image^{xxiii}.

How can you embrace ESG and differentiate yourself in the marketplace?

Think about ESG in a holistic, integrated way.

When we speak with companies about sustainability — even the biggest, best, most reputable companies around — the need for alignment across divisions is clear.

Someone in design or purchasing may suggest that they can't make the switch to a particular polymer type because the additional cost per unit is too high or retooling the production line too expensive. What they're actually doing is putting their company behind the trend when the market inevitably shifts. Not pricing in indirect costs such as extended producer responsibility fees or carbon border adjustment mechanisms, for example, will ultimately cost far more than if they'd been prepared to pay a few more cents per unit for a different kind of polymer.

Without considering the entire life cycle of the product within these ESG decisions, these companies are making missteps, missing opportunities and locking themselves into product formats or sourcing arrangements.

Report ESG data and information to the best available, most credible standards.

Irrespective of where the dust settles, efforts made here will deliver the sound, investment-grade data your organization needs to carve out a competitive edge in the future.



What catalysts will accelerate companies in this direction?

Buyers are hungry for smart homes and smart buildings, and connected device manufacturers have flooded the market with products in an attempt to satiate that demand. Launching products that will connect, stay connected and perform as expected, however, has proven difficult. CSA, Z-Wave, Thread and Bluetooth® are effective but siloed. Until the very recent arrival of the [first agnostic protocol to alleviate interoperability \(IOP\) challenges, Matter^{xxiv}](#), the lack of a unified global standard has made it challenging to build products that successfully connect with others. What's more, there's simply no consensus on what types of security these devices should have.

Consider what seems like a straightforward design challenge: smart home security cameras. You have a camera, a phone, an app and a router located inside the house. On the surface, it sounds simple. It's not. When we begin looking at the wide range of mobile device form factors, each with different OSs, screen sizes and versions of continuously updating applications, we begin to recognize the complexity involved, and that complexity can mask the potential for poor performance outcomes.

With so many moving targets, it's easy to see why designers and manufacturers struggle to meet buyer expectations. After all, when it comes to wireless products, the only constant is change.

The result is unhappy buyers who won't be shy about posting negative reviews.

Connected device designers and manufacturers must be mindful that buyers today hold a lot of power. [Third-party validation critically influences purchasing decisions^{xxv}](#), and reviews are always just a few clicks away. That's why manufacturers of low-performing products are encountering a very difficult market. Even products with four-star reviews can struggle, and that's fair. Buyers rightly expect their connected devices to work seamlessly.

What designers and manufacturers need to understand is that in this rapidly evolving space, purchasing decisions are no longer binary. The question is not, "Is this product certified?" but rather, "Will this device perform, and how well? Will it be easy to use? How does it fare against competitors' products?"

IOP may not be a requirement to enter markets, but you'd be wise to think of it as one; it empowers you to differentiate and create unbeatable market preference.

Many larger connected device designers and manufacturers already have a good grasp on the IOP challenge. Startups and manufacturers making the shift from legacy to connected products, however, often struggle. The path forward appears uncertain, and they don't know quite where to start — there is no single place to look for IOP best practices and requirements, and the complexity increases exponentially when launching into different regions. Those who aren't paying close attention or are cutting corners as they run out of time could launch devices that underperform — and have the negative reviews to show for it.



How can you win over buyers with interoperable devices?

Build your product to connect with others right from the beginning.

Companies want to be in the smart home and building space. They haven't always carefully considered how to address ecosystems, though, and that's a mistake.

We recommend looking critically at which programs you have in place (like Matter, for example) and considering the ecosystems around smart systems.

Likewise, it's crucial that you perform IOP testing with devices that are expected to interact with yours, identifying any connectivity or compatibility flaws well before product launch.

Companies that ensure that their products work as intended can leverage IOP to create a gap between themselves and their competitors. Not only will they earn more positive reviews, but they'll also be in a position to invest more heavily in product innovation; they won't have to unexpectedly divert capital to deliver customer support — expenditures that don't drive revenue or improve the brand.

Define how you want to enter the market, and do it early.

During the product development phase, it's wise to document the testing and certification requirements for each country and/or region in which you plan to launch. Then, design the product with the end goal — those certification requirements — in mind. This supports a smoother certification process and helps you avoid costly redesign at an advanced phase of product development.

Deliver a simple customer onboarding process.

User experience is now the differentiator. Today's buyer expects products to work without a massive undertaking or an engineering mind.

That means ensuring that the library of products you use to validate the interoperability of your product with others should not be limited to just the most recent versions of OSs, applications and routers. You should validate interoperability against older versions, as well.

Buyers expect to open your box, turn on your product and immediately see it interact smoothly with other devices. Whether it does or not will affect how they perceive the device, how they rate it and whether they choose to return it.



Security: Protecting data and physical safety will boost buyer confidence

Cybersecurity stories are no longer relegated to IT trade publications. Now, they regularly make international news and, today, [even the not-so-tech-savvy consumer is hyper-aware of cyber threats](#)^{xxvi}.

As a result, device security increasingly factors into buyer purchasing decisions. In fact, [49% of companies indicate they're "very concerned" about cybersecurity](#)^{xxvii}, as a breach could land them in the news and devastate their brand reputation.

That's why today's more informed, more proactive buyers are looking for assurances that their physical and data security will be protected, and this provides a key area of potential differentiation. Brands that demonstrate that they've gone above and beyond by acquiring security certifications and delivering user-friendly best practices will earn buyers' trust. Of course, this is easily said, and not as easily executed.

Today's global regulatory landscape is rapidly growing more complex. Connected device designers and manufacturers are contending with different regions, different types of devices and different ecosystems, each with its own standards — if there are any standards at all. Just a few U.S. states have established rules — namely, Oregon and California. Likewise, a big box retailer has issued requirements for connected devices to be sold at its stores. These criteria, however, don't provide adequate protection. There simply hasn't been much attention paid to IoT device security in the smart home space, and manufacturers will need to take this into account going forward, especially if they're looking to sell connected products on a global scale.

In the next year or two, however, we expect to see a drive toward more uniform standardization, and it will be led on two fronts: in Europe and the U.S. Put forth by the European Commission, the upcoming [European Radio Equipment Directive \(RED\)](#)^{xxviii} will enforce Articles 3.3 (d), (e) and (f). This means that any type of consumer smart home device [must meet a harmonized standard of security requirements by August 2024](#)^{xxix}, and they haven't yet been published.

In the U.S., the National Institute of Standards and Technology (NIST) has also developed a set of security criteria that will govern connected devices. Developed in response to the 2021 U.S. executive order on improving the nation's cybersecurity, the [Profile of the IoT Core Baseline for Consumer IoT Products was published in NIST IR 8425 in June 2022](#)^{xxx}. It defines recommended security criteria for consumer IoT products, which can serve as a sound starting point for designers and manufacturers as they plot out their product development road maps.

While there are no plans for NIST requirements to be made mandatory yet, they will soon offer an opportunity to create market differentiation. Today, we're simply waiting for industry groups and organizations to formalize their labeling program requirements.

This step, however, will be a big one.

If we look to North America, for example, we see that some baselines exist in certain parts of the country — [in California](#)^{xxxi} and [Oregon](#)^{xxxii}, for example — but the scope of their approximately five security requirements is light. Meanwhile, more widely used consumer IoT baseline standards such as [ETSI EN 303 645](#)^{xxxiii} in Europe or the recently released [NIST IR 8425](#)^{xxxiv} in the United States range between 20 and 50 requirements, depending on device and standard.



How can you capture this security opportunity?

Get certified.

Today's cyber-aware buyer is more likely to consider security certifications when making a purchasing decision.

To take your first steps toward certification, we recommend that you identify the regulations that apply to your connected device in each market and their overlap as part of your overall security posture. While the specific text of particular requirements may vary, they may essentially require the same thing. For example, a retailer might demand a secure method for inputting passwords, while a NIST requirement calls for a method of secure authentication — two different requirements; same core principle.

Then, work proactively with a security team to ensure that your connected device meets baseline security standards. When you do, you'll give buyers more confidence that you will protect their data and physical security.

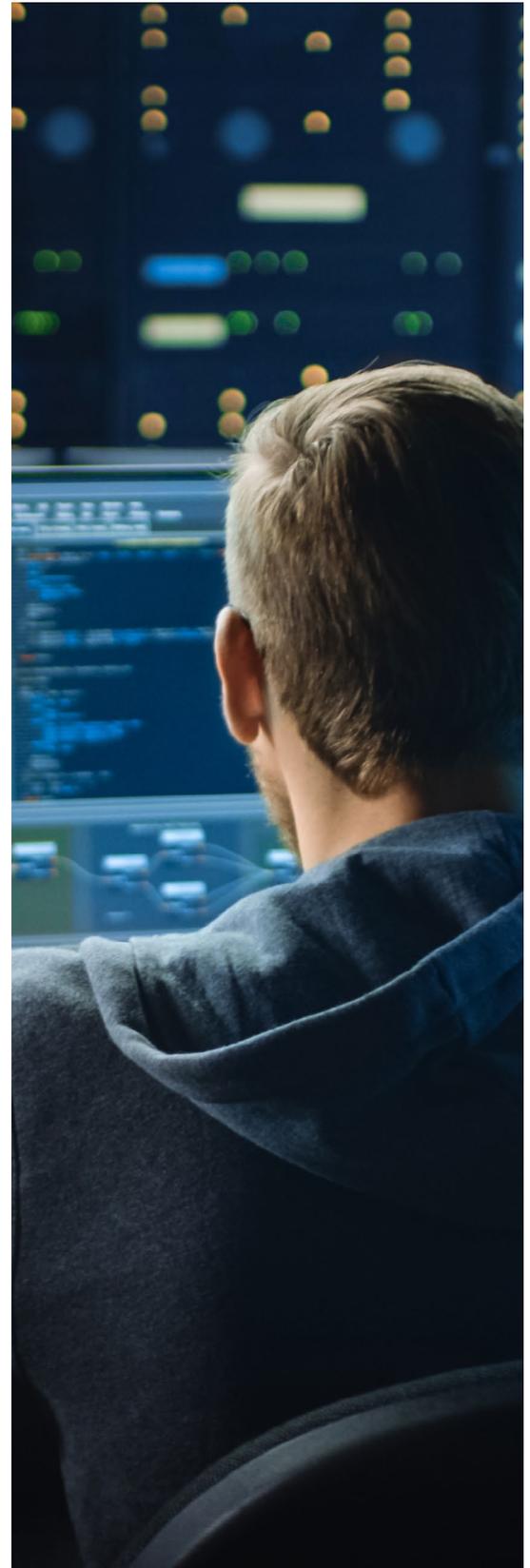
Empower end users to protect their data (and your brand reputation).

No matter how secure your connected device is from a technical perspective, the human factor will always be at play. As you know, end users are often the most vulnerable part of a security system.

No one wants to read an article first thing in the morning and discover that an unsecure setup of their device resulted in a bank breach. When it comes to end users, be vigilant about implementing technical support and providing clear education.

- Force end users to change their default passwords as soon as they're set up.
- Avoid manufacturing connected devices with a one-size-fits-all default password, if possible.
- Deliver clear, simple instructions on the secure setup of your smart device.
- Ensure that customers understand the gravity of cybersecurity threats and support them with simple best practices, like how to create secure passwords.
- Provide vulnerability reporting and point end users to a website that delivers additional information in language that doesn't require an engineering background to understand.

Supporting both enterprise and consumer end users will prove critical. Yes, cyber attackers are more likely to go after a Fortune 500 company than a homeowner with a Chromecast, [but consumers are very aware of the threat](#)^{xxv}. Demonstrate that you're going above and beyond to deliver secure products and you'll realize an opportunity to differentiate yourself in the marketplace.



Want to accelerate the path to success?

Capture opportunities in the connected device market with UL Solutions.

Drawing on a deep well of global consumer and industrial IoT experience, UL Solutions serves as a comprehensive service provider for cybersecurity, interoperability, ESG reporting, regulatory compliance and global market access support, customizing service levels to meet the particular needs of your business.

ESG reporting

UL Solutions can empower you to easily track, measure and report ESG data to a variety of audiences using a wide selection of reporting standards and frameworks.

Whether you're challenged to express your company's sustainability goals or communicate your sustainable supply chain commitment, we can empower you to enhance your reputation with impactful data and reporting tools, including:

- Sustainability management reporting
- Carbon emissions/greenhouse gas (GHG) reporting
- Sustainable product certification
- Sustainable advisory services
- Supply chain and corporate social responsibility (CSR) tools

Interoperability testing

Your IoT devices need to connect, stay connected and perform as expected. When you consider the range of different devices on the market — the different OSs, screen sizes, applications and more — it's a daunting challenge.

Drawing on 15 years of experience, we can help you navigate this growing complexity and deliver the expert support you need to:

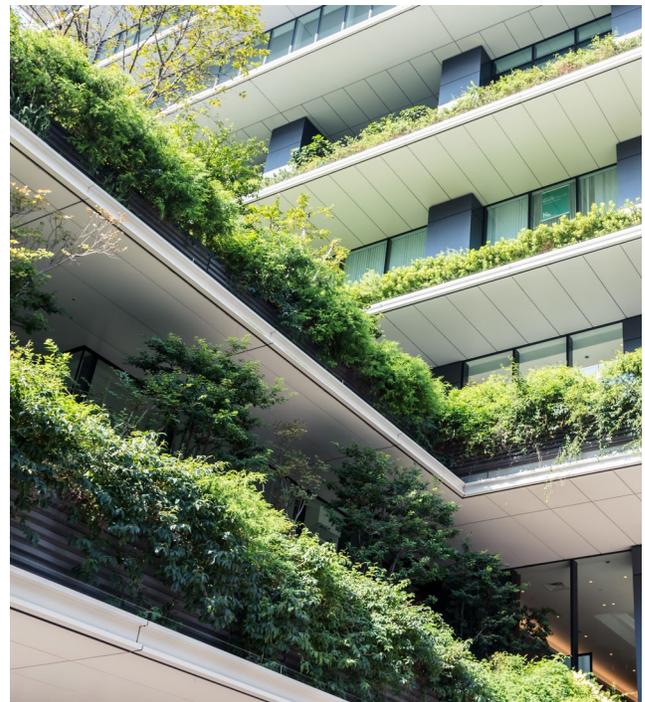
- Validate products to confirm that they perform correctly and securely with a wide range of devices.
- Confirm that your products conform to all appropriate standards and technology platforms.
- Deliver relevant, verified marketing claims that create market preference.

Cybersecurity

UL Solutions can help you identify cyber vulnerabilities in the design and implementation of connected smart systems and devices across your entire supply chain, mitigating the risk that your product will introduce vulnerabilities while also accelerating your path to market.

In addition to the security ratings and compliance-related certifications that enable market access and foster trust, we can also help you set up your internal security structure, empowering you to manage security-related projects in the future, including:

- Defining baseline cybersecurity requirements
- Implementing processes
- Identifying required audits
- Evaluating products to ensure that they meet all steps and can be considered complete



Regulatory compliance

The regulatory landscape is growing increasingly complex. Not only can we help you understand it, we can confirm that your connected devices meet the requirements necessary to enter markets, including:

- Electromagnetic compatibility (EMC) and radio frequency (RF) testing
- Product safety testing
- Health testing
- Specific absorption rate (SAR) testing
- Certification services

Global market access

UL Solutions' global network of local experts covers requirements for more than 180 countries today. We can help you determine connected device requirements for each target market, as well as deliver the guidance you need to:

- Accelerate market access.
- Remain in the market as requirements evolve.
- Assess compliance with local and global regulatory and market requirements.
- Demonstrate compliance with regulatory, sustainability and market requirements.
- Match existing products to new market opportunities.

Getting ahead of connected device trends isn't easy. We're here to help. Learn more at [UL.com/Solutions](https://www.ul.com/Solutions).



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GLOSA23CS954458