

SMART HOMES: A LOOK INTO TODAY'S TRENDS AND OPPORTUNITIES



Smart Homes

A Look into Today's Trends and Opportunities



In an era of smart technology, there really is no place like home.

Today's consumer has come to expect both convenience and cost-savings from the ongoing advancements in new technologies that are reshaping the way people live, work, and operate. Fueled by the expanding capabilities afforded by the Internet of Things (IoT), nowhere is this more evident than in the growing emergence of smart homes.

Powered by computing devices and information technology, smart homes allow for multiple appliances and devices to be automatically and remotely controlled using a mobile or other networked device. With connectivity no longer a stand-alone trend but rather the future of innovation, smart homes are growing in prominence as they answer consumer demands for residential ease, entertainment, and enhanced comfort, all while delivering a variety of solutions in a sustainable way.

TE Connectivity (TE), a world leader in connectivity and sensor technology, has a dedicated focus on the smart home market. We are sharing our insights to help manufacturers capitalize on this opportunity and the various applications that are making smart homes a reality. Designers and engineers need to be aware of the myriad of market factors and consumer trends that are driving growth, as well as the design and technology issues that will impact product development and market adoption.

A Growing Global Market

Over the last few years, the global smart home market has dramatically expanded with the availability of a wide range of high technology products for connected homes. In 2021, the global smart home market was sized at \$62.7 billion, however, by 2030, it is projected to significantly grow and reach \$537 billion.¹ This growth trajectory is being powered by a confluence of factors and trends. Let's take a closer look.

Technology and Market Trends

Underlying the smart home market are technological advancements and market trends facilitating growth. This includes:

- **Enhanced technologies:** Smart homes rely on the strength and bandwidth of wireless technologies to effectively operate. With the advent of 5G, the deployment of the Internet has been boosted to support an increasing number of internet users and allow for connectivity across a wider range of smart home devices.

The result has been the emergence of new and advanced smart home automation systems covering a spectrum of capabilities from centralized streaming entertainment devices and robotic vacuum cleaners to smart safety and surveillance systems. In addition, the integration of Artificial Intelligence (AI) has enabled devices to offer more advanced capabilities, as well as digital sound. For example, through personalization features, the devices can learn about users' behaviors thereby eliminating the need for direct input.

- **Economic factors and greater ease:** Greater disposable income has positively impacted smart home growth as consumers are willing to spend on the heightened accessibility, availability and convenience smart home applications offer. This is particularly true in the developing economies of the Asia Pacific. Dramatically improved standards of living, and a desire for smart and luxurious lifestyles, are driving smart home growth in the region to be the highest in the world.

In addition, as consumers look to enjoy more personal time, they have started deploying smart and intelligent solutions in everyday tasks to reduce workloads at both home and the workplace. It is expected that the use of smart home devices will have a particular impact on chore automation, cutting an average of 100 labor hours annually for a typical household.

- **Government intervention amidst energy concerns:** Energy efficiency and savings are important aspects of any nation's economic development. These concerns have become even more critical in the face of rising concerns over global warming.

As a result, regulatory bodies in North America, Europe and the Asia Pacific, are putting forth requirements and incentive programs that call for energy-saving and low carbon emission-oriented solutions. Smart homes, which heighten control of energy usage and emphasize the use of non-greenhouse gas emitting electrical appliances, are well-positioned to address these new climate-related mandates.

- **Surge in smart buildings:** One of the great drivers in the growth of smart homes is the actual development of smart buildings. With growing urbanization and the prospect of smart cities becoming more of a reality, a surge in smart buildings will only continue to bolster the market's overall growth. While this is a global phenomenon, it is a particularly relevant to the North American market.



Exhibit 1

Smart Home Growth: Regional Dynamics ^{2,3}

The global smart home market is projected to grow and reach \$537 billion by 2030. This is supported by growth in each of the three major global regions as demonstrated below:

North America ⁴	Europe ^{2,5,6}	Asia Pacific ^{7,8}
Market Size: Revenue 2021: \$25.8 B Revenue 2030: \$166.2 B CAGR: 23% Notable growth markets: U.S., Canada	Market Size: Revenue 2021: \$15.7 B Revenue 2030: \$116.8 B CAGR: 24.9% Notable growth markets: U.K., Germany	Market Size: Revenue 2021: \$17.8 B Revenue 2030: \$220.9 B CAGR: 32.3% Notable growth markets: India, China, Japan, and South Korea
Regulatory Impact		
In the United States, reducing energy usage in buildings is central to meeting national energy and environmental goals while also lowering expenses for building owners and tenants	Low-carbon emissions standards are being implemented across the region and led by the United Kingdom, Germany, and France	Efficient use of energy is being promoted by the Chinese government, the Australian Minimum energy performance standards, and the Indian Bureau of Energy Efficiency and Labelling Standards
Market Drivers		
- Increasing number of Internet users - Growing adoption of smart home devices to reduce energy charges and maximize efficiency - Greater demand for safety, security and surveillance, e.g., video doorbells, and lighting solutions - Increasing customer preference for voice-assisted technologies, e.g., Alexa and Google Home - Surging number of smart buildings to reflect growing urbanization - Operating appliances from a smartphone or tablet: 74% of Americans are open to cooking-related automation while 78% are interested in adding smart kitchen appliances to their home in the next five years ⁹	- Ongoing proliferation of smartphones - Ease, convenience and comfort are primary consumer motivators - Significant need to reduce energy costs coupled with low-carbon emission-oriented solutions - Surging importance of home monitoring, convenience and safety and security - Increasing number of manufacturers expanding smart home product portfolios	- Higher standards of living are resulting in the demand for smart and luxurious product lines in smart homes 76% of Chinese consumers are willing to purchase smart home devices due to the convenience and comfortability they offer - Chinese consumers prefer voice commands for smart home devices and connect them to mobile apps - Major global brands, as well as major Chinese manufacturers are serving the market <i>China is the second largest smart home market in the world behind the North American market^{8,15}</i>

Consumer Trends

In addition to technology and market factors, an array of consumer-related trends is also dictating rapid smart home growth.

- **Energy savings and sustainability:** While governments around the world develop energy-related regulations and programs, a desire for energy savings and a growing sense of environmental responsibility top consumer concerns in driving smart home adoption. Consumers are looking for innovative devices to reduce energy usage and consumption as a means to make households greener and more sustainable.

These concerns are playing out around the world. In North America alone, consumer concern about energy consumption is projected to be the most significant factor driving smart home adoption. Energy efficiency is also a leading driver among German consumers. In Europe, HVAC, as a potential solution to low-carbon emission mandates, is forecasted to contribute 44.3% to the region's smart home market, making it the fastest growing application on the continent over the next seven years.¹

- **Security and surveillance:** Consumer concerns around security and surveillance are also driving growth in smart homes. Around the world, home monitoring is of growing interest, particularly in addressing safety concerns over personal property and belongings. Applications include the adoption of video door monitoring, smart alarms, digital locks and lockers, and motion-sensing cameras that can be remotely controlled from a web-enabled device such as a personal computer, tablet, or smart phone. By virtue of these capabilities, homeowners can be alerted to in-house motion detection, or alternatively, police and fire authorities can be immediately notified of imminent threats.

While interest in security and surveillance is a clear response to rapidly growing urbanization, it is of equal importance in remote locations. The result has been a segment that registered a 30.71% market share in 2021¹– the largest share of the global smart home market that year.

- **Pandemic-related lifestyle changes:** Since 2020, the COVID-19 pandemic has dramatically changed the way people live and work around the world. In turn, these changes have had a direct impact on the growth of smart homes with a heightened emphasis on health safety, the ability to manage home systems without physical touch and lower the risk of contagion, has gained greater value. In addition, the increasing demand for the home delivery of goods and services has driven the demand for connectivity options that include voice controlled and smart-enabled access point solutions.

Perhaps even more so, the increasing number of people working-from-home has shifted purchasing to directly reward a host of smart, connected solutions. This includes:

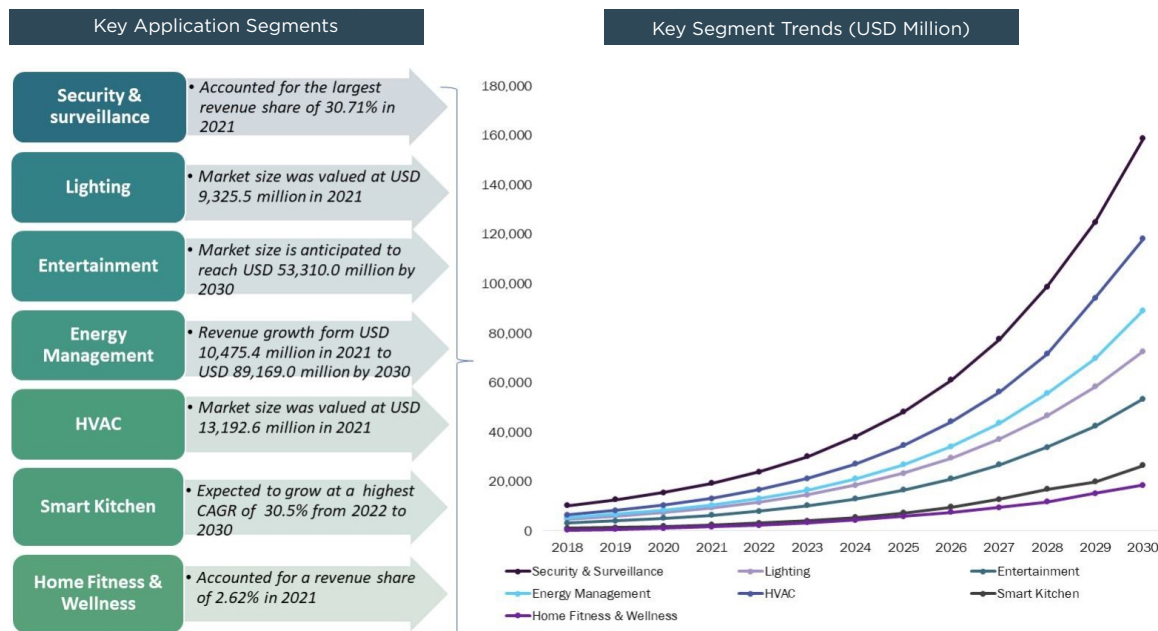
- **Health and wellness solutions:** As consumers spend more time at home and reduce their exposures to health clubs and gym memberships, they have turned to in-home exercise equipment that offers connectivity capabilities. In addition, the growing trend towards personalized health management has meant an increased use in medical devices that must be tied to IoT functionalities within the home.
- **Smart kitchens:** Another direct result of the pandemic has been the surge in home cooking. This has directly impacted the growing interest in smart kitchens and in turn, premium-line products with enhanced functionalities. Further, as cooking confidence and creativity increase, it is expected that customers will have even more heightened expectations on the types of advanced capabilities their appliances offer. These combined measures are expected to make smart kitchens the fastest-growing smart home segment over the next seven years with an estimated CAGR of 30.5% from 2022 to 2030.¹
- **Personalization and appliance upgrades:** ¹⁴ Today's consumers are increasingly focused on lifestyle experiences, looking to have an emotional engagement with the brands they buy. As a result, more consumers invest the time learning about products and personalization options before making a purchase decision. Home appliance manufacturers are recognizing this trend. They are gathering information on consumer preferences to inform their product, design and customization options and are looking at how to integrate smart home appliance trends into larger smart home ecosystems.

In using customer input over the next two-three years, personalized experiences are expected to be at the forefront of making appliances more suitable to a wide variety of styles and home ambiances. However, in the longer term, home appliances are expected to be enhanced to add extra capabilities and functions while also fitting a more modular experience. Appliances that combine features, allow for easier monitoring/repair, and add advanced digital elements to ensure convenience, are expected to become the new standard.⁶

Smart Homes

A Look into Today's Trends and Opportunities

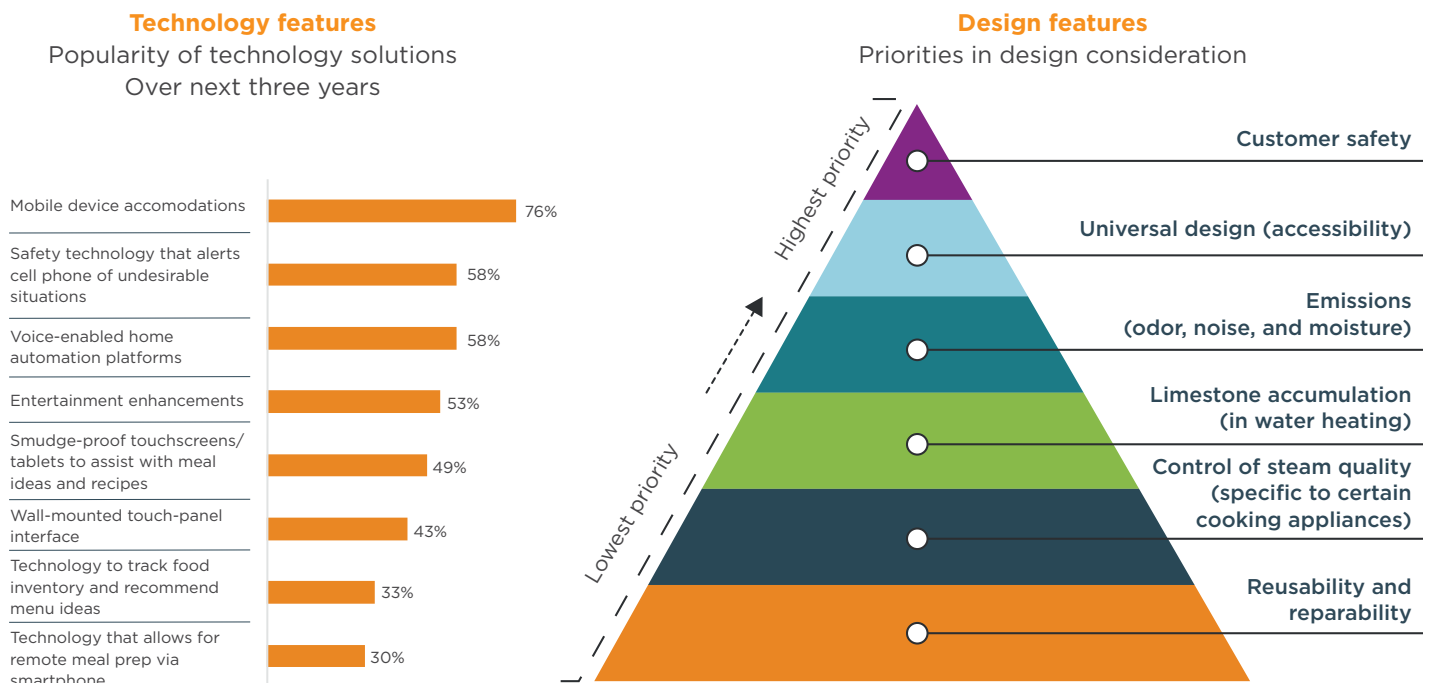
Smart home application opportunities, and their related growth, cut across a variety of segments as demonstrated in the following chart¹



Graphic Sources: 1) [Grand View Research](#)

Key Design Opportunities

As manufacturers look to develop smart home products and take advantage of growth trends, a variety of technology and design issues must be considered. This includes a host of features, reflected in the following chart, with the need for mobile device integrations and voice-enabled platforms being paramount.¹



A Few Challenges

As manufacturers look to support the growth of fully-equipped smart homes, they need to bear in mind a few challenges that impact consumer acceptance and design issues.

- **High installation and maintenance costs:** Installing advanced features and integrating technologies, including IoT, AI, machine language, block chain, and others, into a fully-equipped smart home, is currently an expense that only a more limited, high-net-worth segment of the consumer landscape can afford. In the same vein, the high-cost of converting an ordinary home into a smart home due to its complex set-up, creates another limit on current consumer acceptance.
- **Compatibility issues of smart devices from various manufacturers or vendors:** The smart home market is currently fragmented with many players developing various systems that use a range of technologies. While it is easy to integrate and link up devices from the same manufacturer or vendor, connecting systems from multiple players is a time-consuming job that not only results in a variety of incompatibility issues but more critically, limits functionality, as well as reliability.



Taking a Look at Smart Kitchens

With smart kitchens anticipated to be the fastest growing segment in the smart home category, it is important to take note of the specific trends that are driving its expansion. ⁶

- **Faster cooking is the main purchase driver behind the purchase of smart appliances.** Consumers want more time to multitask while cooking and enjoy a less exhausting and more sustainable overall cooking experience. This makes faster cooking the number one priority in choosing smart appliances. In addition, other purchase drivers include allowing for easier clean-up; learning how to cook; and reducing the need for multiple appliances. ⁹
- **Improving food quality is an area of interest.** Consumers are looking to increase cooking efficiency and precision, plan meals intelligently, and generally improve their health and wellness. As a result, concentrating on enhancing food recognition and integrating that capability into kitchen appliances such as full-size ovens and refrigerators, is an area of growth and opportunity.

Interest in smart appliances all starts with the buying public. While there are generational differences, all age groups are interested in adding smart appliances to their home over the next five years: ⁹

- Gen Z (91%)
- Millennials (91%)
- Gen X (80%)
- Boomers (67%)

Smart Homes

A Look into Today's Trends and Opportunities

- **Functional upgrades are a must.** Smart kitchen equipment should continue to add functionalities such as useful notifications, energy-saving applications, and Wi-Fi capabilities. There are already select examples of this in the market.

Incorporating AI into kitchen appliances is a growing area. For example, makers of voice assistants have been inspired to advance their technologies by integrating application programming interfaces (APIs) into their platforms. This guarantees control over certain appliances by enabling voice capabilities for essential tasks.

For instance, some major appliances already allow consumers to preheat ovens remotely and use voice commands to operate stovetops. There are also smart microwaves that seamlessly download cooking instructions and read barcodes on food products while offering AI voice assistants to create a completely hands-free experience. Moving forward, machine vision and food inventory tracking systems in smart kitchen appliances are expected to detect missing ingredients, indicate food readiness, and recommend the need to raise or lower oven temperatures.

- **A rising interest in cooking is forging unique platform partnerships.** Smart appliance growth is also being facilitated by the growing interest in cooking. As a result, several appliance makers are creating partnerships to offer all-in-one home cooking multi-platforms. Capabilities include providing a seamless cooking journey, digital meal planning, grocery delivery and smart kitchen connectivity.
- **Small, smart kitchen appliances represent the most significant area of growth.** In the smart appliance category, small appliances are driving growth ahead of major appliances. Multicooker and pressure cooker products, which account for 15% of the total small kitchen appliance market on a global scale, are leading the field. There are good reasons for this. Multicookers address the public's increased focus on healthy eating by reducing oils and fat during food preparation, while electric pressure cookers present a solution for consumers living in off-grid and weak-grid conditions.^{5,11}
- **Waste reduction and energy monitoring are key benefits.** While food preparation is the key driver behind the growth in smart refrigerators, microwaves, and ovens, smart appliances also support waste reduction and energy monitoring. With the world's energy demand expected to increase nearly 37% by 2035¹⁰, the adoption of smart home appliances can address energy concerns by enabling real-time communication that directs kitchen equipment to operate at low frequencies and during off-peak hours.
- **Appliance-as-a-service model may be the future.** Over the past decade, the subscription model has changed the way consumers buy everything from software to food. A connected appliance-as-a-service model could transform the way consumers buy home appliances from a transactional model to a service-based one. In this format, consumers would get an appliance that offers the latest features including remote software upgrades, diagnostics, and on-call support. For manufacturers, the long-term economic value of monthly payments in perpetuity could create greater and more predictable revenue streams.^{12,13}
- **Kitchens have become the centerpiece of a home.** The function of the kitchen has also changed, moving from being a place for food preparation to becoming a center for entertaining, mingling, dining, and working among other things. One of the major forces behind the adoption and development of smart and connectable kitchen appliances is designing them with functionalities for integration into a broader smart home ecosystem.





TE Connectivity Leads with Quality Engineering Solutions

TE Connectivity (TE) offers an extensive array of solutions to meet the needs and growing emergence of smart homes. We partner with nearly every major global appliance OEM to support the design and engineering of safer, more sustainable major home appliances.

Our comprehensive portfolio of sensors, connectors, relays, and switch solutions are incorporated into smart home applications. This includes the development of thermostats that adapt to sleep patterns, lighting fixtures that reduce carbon emissions, security systems that respond to voice commands, and kitchen appliances that hasten meal preparation.

Solutions Portfolio

- **Interconnect Solutions:** Our expansive portfolio of products across a comprehensive range of industry applications, includes innovations in power, data, and signal connectors.
- **Sensor Solutions:** As one of the largest sensor companies in the world, our innovative sensor solutions help customers transform concepts into smart, connected creations.
- **Relay Solutions:** Our relays, contactors, and switches can be used nearly anywhere and in any design for access control systems, lighting, building systems, HVAC, and an array of safety-critical applications.
- **Switch Solutions:** From miniature printed circuit board mounted DIP switches to tactile switches for use in household appliances, our comprehensive line of switches can be used in lighting, building systems, solar, HVAC, and an array of safety-critical applications.
- **Antenna Solutions:** Our standard and custom antenna solutions, whether embedded or multi-element external antennas, offer endless possibilities to create wireless devices with several combinations of features in a variety of shapes or sizes. Our designs also accommodate numerous sets of frequency bands for operation on most networks on a global basis.
- **Passive Component Solutions:** From standard miniature SMD components to custom products, our passive components include resistors, capacitors, chokes, and inductors for use across many applications; in addition, many of our power resistors can be customized to meet specific needs.

Smart Homes

A Look into Today's Trends and Opportunities

As a global industrial technology leader, TE is equally committed to listening to customer requirements and finding new and innovative ways to develop solutions that realize the most complex design challenges. With more than 7,000 engineers across 150 countries, we innovate alongside our customers and clients, sharing our expertise gained from extensive cross-industry, hands-on experience. As a result, we hold many active and pending technology patents that address fast evolving consumer demands. Our size and scale also allow us to expedite product development timelines in bringing products quickly to market.

				
SEALING	RELIABILITY	MINIATURIZATION	SIMPLIFICATION	SAFETY
Ingress protection (IP) rating for water, dust, and debris in harsh environments	High power and operating temperatures, locking mechanisms, and vibration resistance	Compact centerline and smaller construction size	Insulation displacement (IDC) technology, ease of installation, and simplified assembly processes	Flame retardant material, ergonomic design, and insulation protection

More importantly, our approach is built on developing solutions to deliver reliable, steady optimized performance for smart home applications, including for those that operate in the harshest environments. From the trends in miniaturization and simplification to continually testing the safety of products in our labs, we are committed to delivering value across the connectivity spectrum.

Finding ways to solve customer design challenges while maintaining or increasing reliability and performance is just one of the ways TE lives up to its purpose of creating a safer, sustainable, productive, and connected future. After all, it's important to connect the world like it depends on it. Because it does.



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