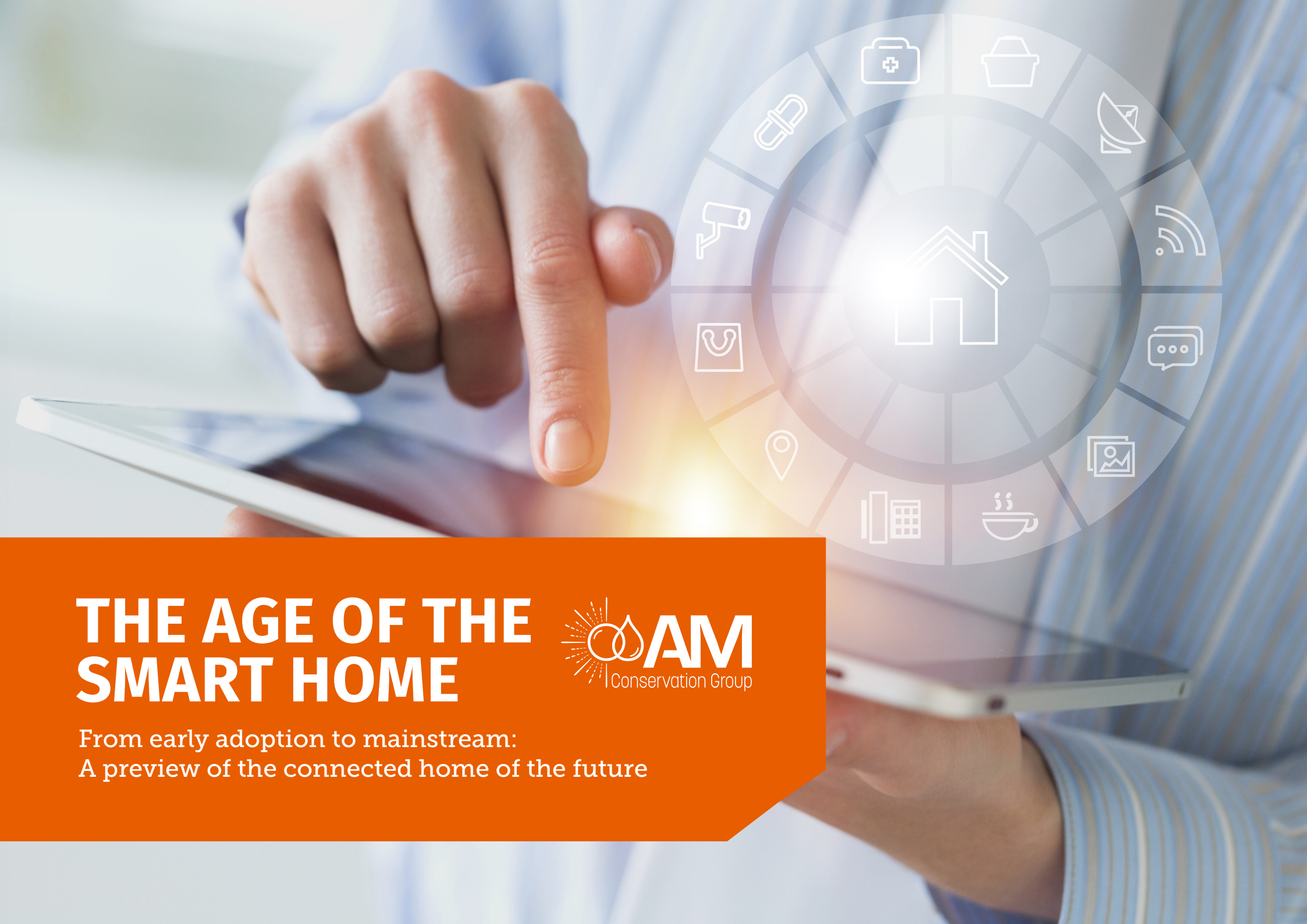


# THE AGE OF THE SMART HOME

AM Conservation Group

From early adoption to mainstream:
A preview of the connected home of the future

# TABLE OF CONTENTS

# INTRODUCTION:
# ENVISIONING THE CONNECTED HOME OF TOMORROW, TODAY

Imagine the home of the future: devices and technology have evolved to become unobtrusive, merging into the background of our home's interior. Lights turn on and off as you move from room to room. The technology is inconspicuous. It's like a server at a fancy restaurant: attentive to your every whim—but discreetly so.

Even better, you are not glued to your screen because the screens stay out of sight: No control panels, no apps even. It's a seamless, inside job because your house understands exactly who you are, where you are and what you want.

As the Internet of Things (IoT) grows, it's poised on the brink of permeating our dwelling places, invisibly occupying the cell waves and fiber optics of our home hub. A home responsive to touch and presence, a home that can adapt to our unique behavior patterns through a learning algorithm.

Technically speaking, our working definition of a smart home combines artificial intelligence, energy efficiency and wireless technology to create a common communication system in service to a responsive home environment. The smart home means technologies such as smart thermostats, appliances and lighting wirelessly work together to increase residents' comfort and convenience in their homes. Through software, sensors and other hardware, residents can even monitor their homes when they are away. The potential for smart homes ranges from changing the paradigm of energy usage to permitting the steadily growing aging population to age in place.

Of course, security breaches are a valid concern, so while the new frontier fairly bristles with possibility, the bigger picture has yet to unfold. But the smart home of tomorrow is coming. We explain many of the compelling reasons to get in front of the trend in Chapter 1.

# CHAPTER 1 : OBJECTIVES OF THE SMART HOME

A confluence of factors drives the smart home movement—and market. The major drivers for the global smart housing market are energy and cost savings, the increasing aging population and the marked improvements in comfort and convenience. As more people get used to—and feel comfortable with—automation, the market, seeded by early adopters, is primed to take significant leaps.

According to Value Walk, a news and opinion website that covers financial and investing news, “Five years ago, just 13 percent of American households had some sort of smart technology integrated into their homes. In 2019, it’s anticipated that at least 38 percent of American households will have entered the market.” Beyond the energy and cost savings, which we’ll examine in more detail in Chapter 2, let’s explore several auxiliary perks of the smart home.

One of the main objectives of the smart home is to ease daily life by increasing user comfort. It does this by automating typical routines as well as allowing you to manage your home systems remotely. By automating many aspects of daily living through remote technology, a smart home can give you the ability to control electronics and appliances from a smartphone, tablet or laptop. It adds an extra level of convenience, which these days is synonymous with comfort.

### *The smart home in action …*

For example, on a hot day, you can adjust your AC using the Nest iPhone app when you are on your way home—so by the time you get home it will be refreshingly cool.

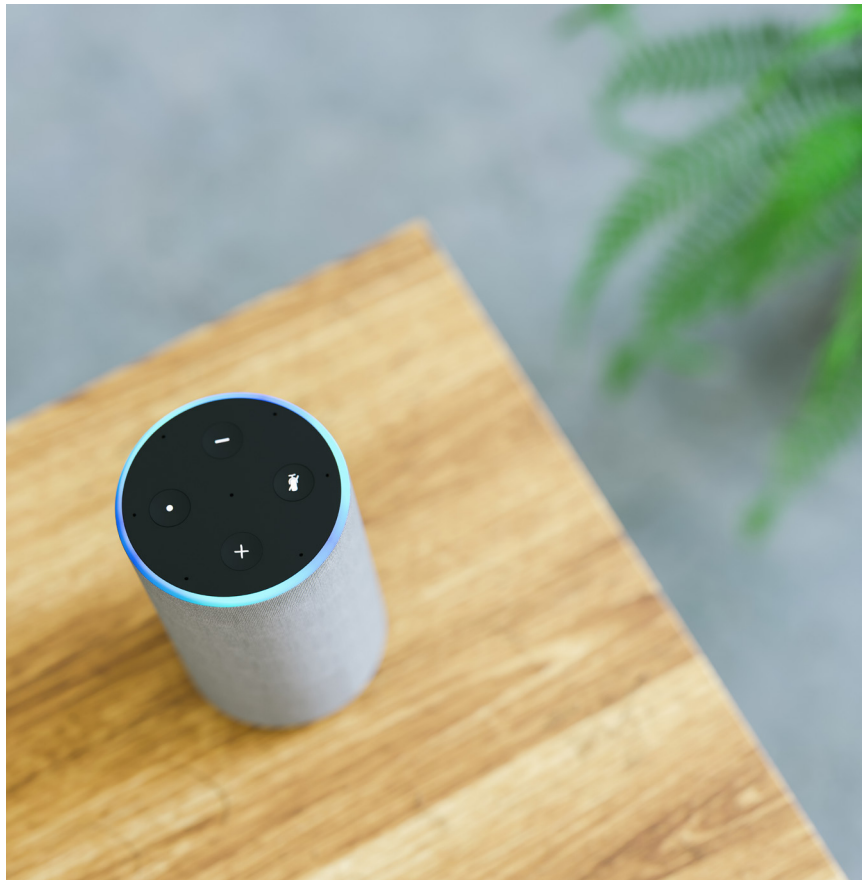
# IDENTIFICATION AND AUTOMATION

A context-aware smart home can distinguish location, identity, activity and time. Smart home technology is considered synonymous with home automation and often referred to as such.

As part of the vision for IoT, smart home automation systems and devices will ideally operate together, sharing consumer usage data among themselves to determine an algorithm of automated actions based on the homeowners' preferences. We're not there yet, but will hopefully get to that point soon.

***The smart home in action …***

Smart speakers connect to the Internet to access content through applications, such as on-demand podcasts and music. Standalone smart speakers are voice-controlled, using hands-free technology to access voice assistants such as Amazon's Alexa, Sonos One and the Apple HomePod.



# HEALTHCARE

A smart home with integrated e-health and assisted living technology can play a pivotal role in revolutionizing the healthcare system for the elderly, the disabled and those with functional limitations. Households can mesh smart home principles with necessary assistive technology, enabling the end-users to live as independently and securely as possible. Alongside the more typical smart home innovations, some instruments and devices allow healthcare professionals to monitor the residents' behaviors/physiological indications and provide assistance for various physical and neurological disabilities.

***The smart home in action …***

Smart homes are outfitted with unobtrusive and noninvasive environmental and physiological sensors that include temperature, humidity and smoke in the home, as well as heart rate, body temperature, blood pressure and blood oxygen level.

# SECURITY

One of the drawbacks of the prodigious connectivity of the smart home is its vulnerability to security threats. Most security problems stem from weak authentication protocols, with the added complication that security attacks may be generated locally or remotely.

***The smart home in action …***

Many vigilant homeowners like the idea of home security cameras with 24/7 live streaming. The technology is advanced enough to differentiate people from pets and intruders from residents. It can even listen for conspicuous sounds, like a boom or the crash of a window breaking.

CHAPTER TWO

# THE VARIETIES OF SMART HOME TECHNOLOGY

# CHAPTER 2 :
# THE VARIETIES OF SMART HOME TECHNOLOGY

One of the most compelling advantages of the smart home is that it increases energy efficiency by reducing unnecessary usage and trimming utility bills.

According to a 2018 ACEEE report, Energy Impacts of Smart Home Technologies, “U.S. homes can lower their energy use by up to one-sixth simply by incorporating smart technologies.” And with each new iteration, the technology becomes more viable, affordable and user friendly.

Smart thermostats alone are claiming a huge percent of market share, with an estimated sales increase of 23 percent annually through 2022 to 14.5 million units. According to Business Insider, investment in IoT solutions by manufacturers is predicted to increase from $29 billion in 2015 to $70 billion in 2020.

## APPLIANCES AND ELECTRONICS

Smart appliances are typical household appliances embedded with the ability to receive, interpret and act on signals sent remotely. They are vocal, flexible and self-aware, able to send alerts, adjust their schedule and self-diagnose mechanical issues. Some smart features, such as clothes drying sensors embedded in dryers to indicate when a load is dry, have been available for more than a decade. But new technologies and expanded connectivity give residents new ways to interact with and control dishwashers, laundry machines, fridges, televisions and speakers.

***Buzzword: Load shifting***
One of smart appliances' key strategies is load shifting—in other words, shifting energy consumption to a time when demand and prices are lower.

***Energy impact:*** Cost reductions of 2 to 9 percent are possible across the major appliance types.

# LIGHTING

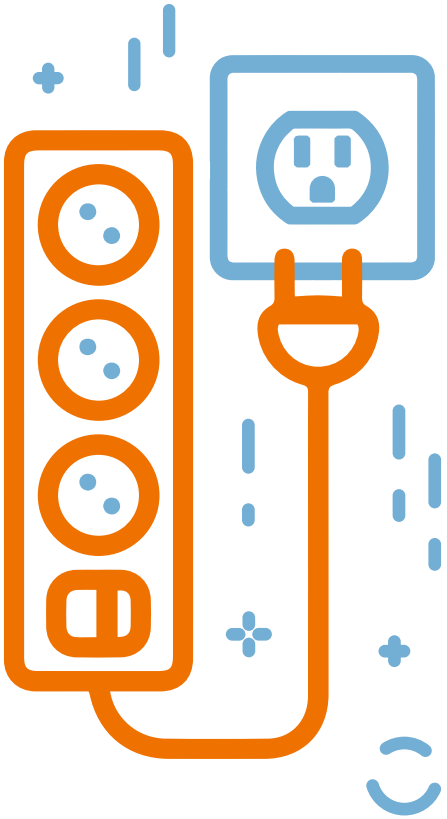
Smart lighting not only offers flexibility with lighting levels through dimmers, but also complements home security systems to boost safety. Smart lighting can be controlled through remote or onsite signals via three options: a personal handheld device, a smart speaker or a smart hub (a device that can centralize control inside the home). Smart lamps, comprised of LED bulbs and integrated fixtures such as recessed or can lights, integrate advanced LED features like dimming and color tuning. The lamps connect wirelessly to each other and often can be turned on and off via an app on a smart phone.

One of the advantages of LEDs is retrofitting as they can replace any bulb with a standard screw-in base. With specialty (e.g., track, flood) and decorative (e.g., candelabra, globe, filament) bulbs now available in LED, the options for smart lighting have expanded.

***Energy impact:*** According to Efficiency Vermont, a small pilot study showed that using smart bulbs could reduce hours of use by 7 to 27 percent annually depending on lamp location. High-use areas in the home could potentially yield even greater results because of the reduction in standby power draw. Standby power draw remains a challenge of smart lighting's efficiency, since lamps continue to use power even when turned off.

## OUTLETS AND POWER STRIPS

Smart plugs and outlets can automate the control of any device with an AC plug. Able to be controlled remotely through apps, smart outlets replace existing wall outlets. Smart plugs, outlets and advanced power strips (APS) save energy by cutting power to plugged-in devices when they are not in use. They can turn off devices automatically, limiting both standby and active power consumption. Tier 1 and Tier 2 APS are designed primarily for the home office and entertainment center, where there tends to be a high concentration of consumer electronics, and are also appropriate for many small business applications.



***Buzzword: Vampire loads***

The myriad devices we all can't live without today contribute to increasing plug loads in most homes and small businesses. Phantom energy sources, such as rarely used kitchen appliances, computers and printers, DVRs, mobile devices and video gaming consoles, carry a plug load even when the appliance is sleeping, hence the term vampire load.

***Energy impact:***According to research by the National Renewable Energy Laboratory, these vampire loads account for as much as 10 percent of the average household's energy bills every year. Efficiency Vermont says you can save as much as $100 per year by avoiding standby load for game consoles alone.

## WINDOW COVERINGS

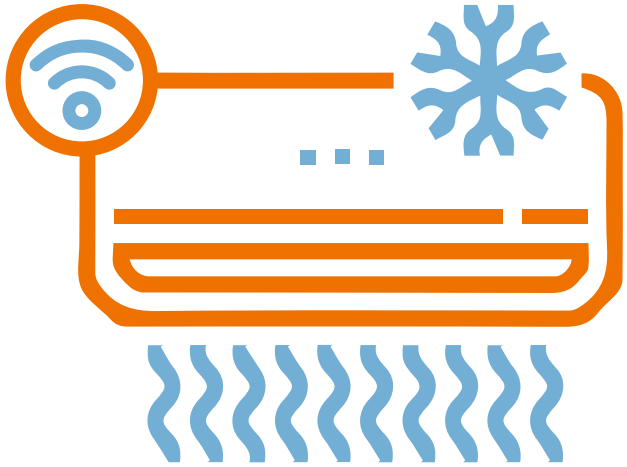
Smart window coverings consist of wireless motorized shades and blinds that rise, lower or tilt automatically. They respond to changes in daylight by adjusting their height or angle and can also be controlled by preset schedules. Smart shades and blinds replace conventional window treatments, although some existing window blinds and shades brands can be retrofitted with wireless motors.

Because the technology driving motorized window blinds is still pricy, smart home enthusiasts are eagerly awaiting the launch of Ikea's smart window blinds, slated to arrive in the US the beginning of April 2019. Called Fyrtur, the blinds fabric is designed to completely block sunlight, and being Ikea, they'll likely be the first truly affordable smart window coverings to hit the market. Once they do, smart window coverings will be poised to scale.

***Energy impact:*** According to an ACEEE report, smart window coverings can provide HVAC savings of 11 to 20 percent and lighting savings of 3 percent. However, the window controls' standby mode does create a power draw. The energy impacts are made even more complex by the fact that they are interconnected and interrelated to heating, cooling and lighting. Closing shades and blinds to reduce heat may actually increase lighting energy consumption. Opening them to optimize for daylight may increase heat gain, which, depending on the season, can increase or decrease energy consumption.

## HVAC

A smart HVAC system makes temperature zoning a new reality. Sensors collect temperature and humidity readings in each room and connect wirelessly to the home's thermostat. A smart HVAC system uses sensor and local weather data to optimize when and how rooms are heated or cooled. As the technology progresses, smart HVAC may also incorporate smart vents—air supply registers embedded with occupancy sensors—that automatically close when rooms are vacant. Already, some smart vents on the market pair with Nest and ecobee smart thermostats and can respond to commands from the thermostat.



***Buzzword: Geofence***

A geofence is a perimeter boundary created around the location of a smartphone or other device, based on GPS or RFID signals. Geofencing in the past has mainly been used for targeted advertising, but is now being applied to home automation.

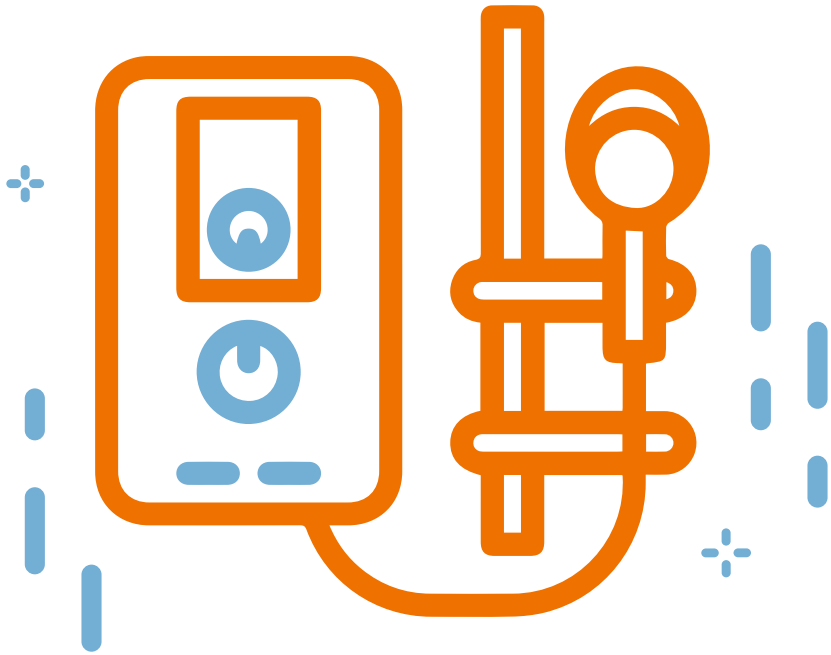
***Energy impact:*** Most single-family homes in the United States have central HVAC systems that condition all rooms at one time despite occupancy. According to an ACEEE report, smart zoning could result in 10 percent HVAC energy savings, on average.

# WATER HEATING

Smart water heater controls prevent the unnecessary heating of water. By integrating analytics to learn household water use patterns, they heat water only at times of anticipated need. During periods of inactivity, the water heater idles and the temperature drifts within an acceptable range.

***Buzzword: Heat pump water heaters***
Heat pump water heaters generate heat by moving water from one place to another instead of generating heat directly. They are heat engines run backwards—think of a refrigerator in reverse.

***Energy impact:*** Roughly two to three times more efficient than conventional electric resistance water heaters, smart water heater controls can achieve energy cost savings of $50 to $200 per participant per year depending on energy market conditions. According to an ACEEE report, these savings could pay back the incremental cost of a smart control retrofit in one to three years.



# THERMOSTATS

Smart thermostats incorporate inputs from the local weather station and from wireless sensors that monitor temperature, humidity and occupancy. A smart thermostat automates your home's HVAC to respond to occupancy, behavior patterns and changes in weather. It can even communicate with other connected devices, particularly ones that utilize geofencing, throughout the home.

***Buzzword: Gateway***

An ACEEE report defines gateway as "a router that regulates wireless, bidirectional communications between two dissimilar networks. In a smart home, the gateway converts the communications protocol of the utility's network to that of the home so that the utility can communicate with the home's smart devices (and vice versa).

***Energy impact:*** Estimates of energy savings from smart thermostats vary widely. Many manufacturers report HVAC savings of anywhere from 10 to 20 percent, while third party evaluations on smart thermostats tend to be closer to 10 percent. Savings also vary regionally, with cooling savings skewing upwards to 20 percent in warm, humid climates and hovering at 15 percent in heating savings for homes in very cold climates.

CHAPTER THREE

# CHALLENGES TO ADOPTION

# CHAPTER 3 :
# CHALLENGES TO ADOPTION

Although sales of smart home devices are ramping up, the interoperability factor—compatible platform integration—makes some prospective consumers wary.

A recent industry research report, published by the international firm Parks Associates, states, "This demand for interoperability is stronger than brand loyalty, as less than 60 percent of smart home shoppers consider it important that their future purchases be the same brand as their current products." Currently, the market is fragmented. The fragmentation translates into a clunky path to home automation, with an increased potential for bugs and glitches.

According to an article published by Punchcut, an innovation company specializing in connected services across devices, "We heard over and over again frustrations around device integration throughout the home. Most users have been buying one-off smart products from disparate manufacturers that solve very specific home automation needs, however, they are unable to interoperate multiple devices on one holistic ecosystem. Not one single platform achieves this. Proprietary systems are limiting while disorganized protocols and formats create barriers." This adds complexity, which when combined with the investment smart home devices entails, can discourage market entry. Here are a few of the biggest barriers to adoption.

## COST

The cost coupled with consumers not fully cognizant of the quantifiable value of the connected home leave many potential consumers biding their time before taking the plunge. A survey by ACEEE found that “five out of nine program administrators said they believe that technology cost is the biggest barrier to adoption. The slow uptake of residential smart window coverings is certainly a case in point.”

## COMPLEXITY

Even DIY tech geeks can quickly become overwhelmed by installing an integrated smart home system. It can take a lot of time to figure out how to “save time” through automation—which poses a major deterrent to buy-in. Having professionals install a smart home system simplifies the process, but that bumps up cost significantly. Because mainstream awareness is still minimal, many people are not up to speed on what it should cost and whether it’s a worthwhile investment.

## DATA SECURITY

After the euphoria of internet connectivity comes its shadow—the implicit threat of lapses in cybersecurity. Many connected devices record personal conversations and track personal details, such as the home’s address and occupant information as well as vacancy and occupancy patterns. If that information fell into the wrong hands, it could make homes vulnerable to break-ins or data hacks. An ACEEE report cites the sobering statistic that “64 percent of Americans have already experienced a major personal data breach in their lifetime.”

## INTEROPERABILITY

The lack of compatibly across connected devices poses a huge obstacle to smartening the home. In order to achieve peak intelligence, all home devices must connect to and communicate with one other. Proprietary systems still don't cross-pollinate and make connectivity a headache, disincentivizing the typical homeowner who seeks an easy way to connect his or her devices.

## INTERNET ACCESS

Although many of us take high-speed Internet connections for granted, good internet service can be unpredictable in rural locals. Without it, the smart home concept is crippled. According to a 2016 census report, 19 percent of all US households do not have broadband Internet service. While some pioneering utilities and statewide programs are integrating broadband access initiatives into their demand side management (DSM) programs, this continues to be a barrier.

# CHAPTER 4 :
# FIVE TRENDS OF THE SMART HOME 2.0

Smart homes still face the problems of immature intelligence hampering functionality. But as intelligence systems mature, including more sophisticated algorithms, activity recognition methods and prediction accuracy, smart homes will transform into a sleeker incarnation. The gold standard: a multiagent, interoperable system with distributed intelligence by integrated smart appliances across platforms. To get there, here are five trends to watch that herald the smart home 2.0.

## #1 CUSTOMIZATION

Every home is unique: A different footprint, region and orientation, combined with very specific needs and priorities to create countless permutations. Adaptable products will encourage people to invest in and extend their individual systems.

## #2 CONSOLIDATION

Everybody dreams of eradicating the profligate remotes and consolidating to just one central universal remote. It's the holy grail promise of the smart home. As the focus on platform lock-in recedes, and greater cross-compatibly standards spreads, a one-remote reality becomes more viable.

## #3 HOME DATA SHARING

The next phase of smart home technology may involve more sharing and caring—as in data sharing with businesses. Think having your fridge restock your milk automatically. Smart device data will be highly prized among the companies directly connected to the supply chain.

## #4 UPTICK IN CUSTOMER SERVICE

Forward-thinking smart home device companies will use customer service as a way to stand out. As previously noted, there are several ways an IoT environment can present a number of frustrations for consumers, from basic troubleshooting to security breaches. Companies that go the extra mile to deliver exceptional customer service will be rewarded by grateful consumers.

## #5 INCREASED VOICE RECOGNITION

Voice control of technologies such as phone, TV, home audio and even car dashboard will be commonplace by the end of 2019. Voice activated tech will become ubiquitous, taking over the IoT. Household objects from refrigerators to alarms, washers to mirrors will be imbued with voice capabilities. You'll probably be able to have a conversation with most of your household objects, a good incentive, perhaps, for decluttering.

# CONCLUSION


14:21
75%
NET
Smart Home Control
22.3
54%
23.0
Warm LED
Lights
66%
16:09 / 22:21
Lighting
Network
Camera

# CONCLUSION

## THE THREE CS: COLLABORATION, COLLABORATION AND COLLABORATION

As counterintuitive as it may seem in our hard-driving capitalist-oriented culture, a collaborative approach among smart home device manufacturers will actually advance the smart home market best. If tech providers also join in the collaborative spirit to educate consumers and offer guidance on smart technologies, a huge momentum will begin to coalesce among the broader population. Entry into the smart home market is already being enhanced by forward-thinking home performance and low-income programs that have started to integrate smart home products, such as thermostats—the smart home gateway drug—into their protocols.

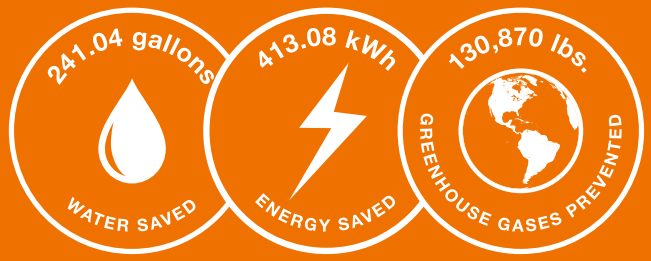
## THE HUNDREDTH MONKEY

Consumer acceptance of home automation has evolved beyond geeks and early adopters. As adoption reaches critical mass, experts predict a smart home boom.

Slowly but steadily, a multipronged urgency for a more sustainable way of life is intensifying. Utilities realize the benefits of incorporating smart technologies into their residential energy efficiency and demand response programs. Home owners realize how cost-effective smart measures can be, especially when paired with incentives. Low-cost plug-and-play devices such as smart LED bulbs, Tier 1 APS and smart plugs increase consumer attentiveness and generate dynamic interest in other smart home devices.

Noticeable home performance improvements, along with sizable cost savings, spur enthusiasm, buzz and ultimately purchase. The bottom line of the hundredth monkey theory is that innovation spawns innovation. As energy-efficient systems and devices increase, they will give connectivity a whole new import.

## Digital Content Savings






AM Conservation Group

www.amconservationgroup.com



Publisher: DSB Communications, LLC • www.dsbcommunications.com