

# *Home Technology Relative to the Sustainable Initiative*

*Presented by:*



*and*



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NAHB Home  
Technology Alliance

CEDIA thanks the following individual(s) for serving as Subject Matter Expert(s) in the development of this course:

Mario Leone

Home Technology Relative to the  
*Sustainable Initiative*

Presented by: Gordon van Zuiden  
President, cyberManor



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Hello, my name is...

*Gordon*

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**Meet the Instructor – Gordon van Zuiden**

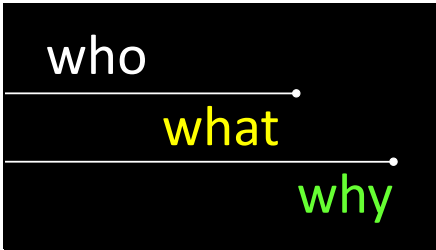
- Founder of cyberManor in 1999, located in Los Gatos, CA
- 20+ years experience in PC and networking sales and support
- Currently in second term on CEDIA's Board of Directors, Certified Instructor, past Co-Dean for Expo Education, serves on Green Action Committee
- Monthly networking columnist for Residential Systems and Electronic House Magazine
- In 2008 cyberManor was awarded first place in Microsoft's Ultimate Installation national competition for a media center integrated project completed in Northern California.

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- CEDIA is an international trade association and education provider.
- ESCs plan, design, install, program, and service low-voltage electronic systems (ESCs are not electricians).
- The ROI program allows education and relationship-building at a grassroots level.

The **Home Technology Alliance** (HTA) is a partnership between **CEDIA** and **NAHB** that was formed to position the housing industry to effectively meet the growing consumer demand for home technology and provide maximum return on investment in the new home building and remodeling process.



- Provides resources.
- Provides solutions.
- Provides education.

**learning objectives**



- Define a green home
- List ways to reduce and monitor energy usage
- Define specific energy reduction benefits relative to:
  - ✓ Lighting
  - ✓ Lighting control
  - ✓ Motorization
  - ✓ HVAC
- Recognize essential criteria for engaging an electronic systems professional in the design and build process

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- Energy and water efficient.
- Environmentally responsible.
- Healthy.
- Durable.
- Comfortable.

Building a green home is more than making it energy efficient; one must look at the big picture.

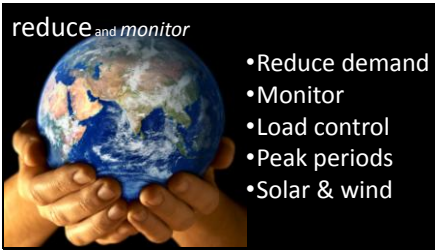
Efficient usage of resources is most definitely a design criteria. The usage of electric, water, gas, oil, and all the other consumable resources should be reduced, and used wisely. In the realm of electronics, make sure components and systems have a low carbon footprint, and are turned off when not on use.

The home and its surrounding should be a good environmental citizen.

A green home must also be a healthy environment for its occupants.

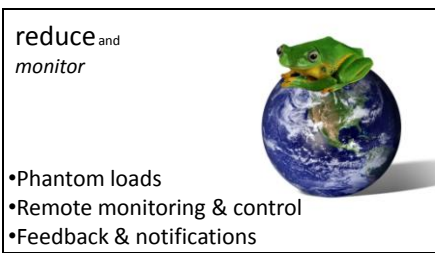
Durability is one of the most prized attributes of a green building.

Comfort is an often overlooked attribute of a green building.



- Reduce demand.
- Monitoring.
- Load control.
- Peak periods.
- Solar and wind.

The best way to reduce one's dependency on grid power is to reduce consumption, not increase co-generation capability.



- Phantom loads.
- Remote monitoring and control.
- Feedback and notifications.

One of the biggest challenges in load management is phantom loads – a.k.a. standby losses.

Remote monitoring and control of a building can enable the owner to manage their home from afar.

Having autonomous feedback and notification of significant energy waste can dramatically reduce a building's consumption.




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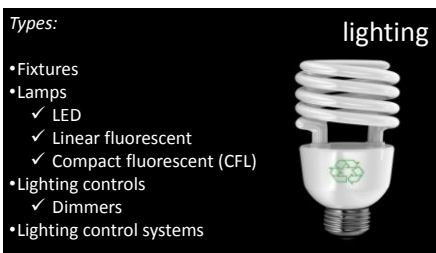
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- Device selection:
  - ✓ Standby
  - ✓ Efficiency
  - ✓ Best choice for space

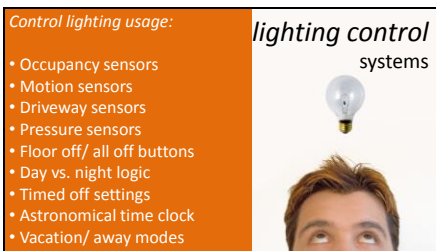
An even better solution to the phantom load problem is to choose devices that do not consume power when not being used, or to minimize standby power consumption.

Additionally, make sure the device chosen is appropriate for the space.



- Fixtures.
- Lamps:
- Lighting controls:
- Lighting control systems.

Lighting can represent a significant electrical load and cost in the operation of a home. Going green means getting a handle on this technology.

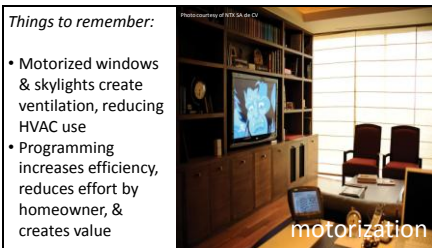


- Minimize unnecessary use by:
  - ✓ Occupancy sensors (bathrooms)
  - ✓ Motion sensors (exterior)
  - ✓ Driveway sensors
  - ✓ Pressure sensors (stairs, bedside)
  - ✓ Floor off/all off buttons
  - ✓ Day vs. night logic
  - ✓ Timed off settings
  - ✓ Astronomical time clock
  - ✓ Vacation/Away modes



- Motorization of:
  - ✓ Shades
  - ✓ Awnings
  - ✓ Windows
  - ✓ Skylights

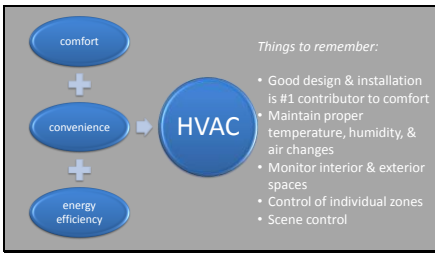
Motorizing and controlling shades and awnings can help reduce heat load due to solar gain (or in the winter, increase solar gain) but its effect is only marginal. Using a good envelope design, high efficiency glazing, and keeping the glazing to floor ratio at 18% or less will garner a better economy.



- Motorization of:
  - ✓ Shades
  - ✓ Awnings
  - ✓ Windows
  - ✓ Skylights

However, motorized windows and skylights are areas where building automation and control can really start to shine. Being able to recognize the optimal time to ventilate can shed significant HVAC operational costs, especially in the swing months.

Additionally, programming the system to recognize timed sequences reduces effort by the homeowner, increases energy efficiency, and creates value to the client.

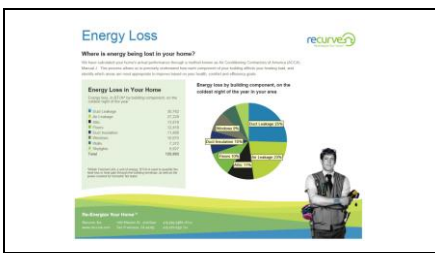


Attributes of the HVAC system related to energy efficiency.

•HVAC contributes to homeowner comfort, convenience, and the home's energy efficiency.

Things to remember regarding HVAC systems and energy efficiency:

1. The combination of a good envelope design and a properly designed and installed HVAC system is the #1 contributor to occupant comfort.
2. Remember, occupant comfort is not based on air temperature, but rather, the mean radiant temperature of the space.
3. Maintain proper space temperature (mean radiant), humidity, and adequate air changes.
4. The system should monitor both interior and exterior spaces to be able to anticipate interior needs and to determine if/ when to use ventilation for temperature control.
5. Interior spaces (zones) may be individually controlled to balance space needs.
6. Scene control, such as Setback when in Away and Vacation modes, can be a great energy saver. Be aware of potential problems of excessive temperature and humidity swings.




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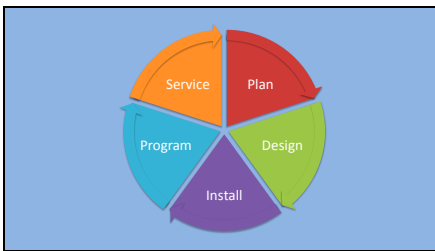
*cooperative system* mentality

- A home is a collection of systems (electronic & non-electronic)
- Collection of independent systems operating separately vs. as one
  - ESCs can tie systems together

Cooperative system mentality.

- A home is a collection of systems (electronic and non-electronic).
- Collection of independent systems operating separately vs. as one.
- ESCs can tie it all together.

A home is a collection of many systems (foundation system, framing system, roofing system, plumbing system, HVAC system, etc.). In order for a building to function properly, all the systems must be properly integrated together to operate as one. Independent electronic systems can support the homeowner's lifestyle within the narrow scope of the system. Independent systems will provide technological support for the homeowner; however, the convenience or comfort factor will be compromised.




- ESCs plan, design, install, program, and service low-voltage residential systems.
- ESCs educate you, your staff, and clients about product options and technology solutions appropriate for the project.
- ESCs assume responsibility for system performance and client satisfaction.
- ESCs provide necessary information for subcontractor bids.



- Proper planning with an ESC:
  - ✓ Keeps electronics from looking like an afterthought
  - ✓ Ensures client's technology needs are being addressed
  - ✓ Provides the necessary infrastructure to support current and future electronics
- Engage the ESC early.
- Two-three months prior to completion of construction drawings.

summary of discussion



- Defined a green home
- Listed ways to reduce and monitor energy usage
- Defined specific energy reduction benefits relative to:
  - ✓ Lighting
  - ✓ Lighting Control
  - ✓ Motorization
  - ✓ HVAC
- Discussed essential criteria for engaging an electronic systems professional in the design and build process

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[CEDIA Web Site:](http://www.cedia.org)  
[www.cedia.org](http://www.cedia.org)

[Electronic Lifestyles® Finder Service:](http://www.cedia.org)  
[www.cedia.org](http://www.cedia.org)

[CEDIA Crosspoint Web Portal:](http://www.cediacrosspoint.com)  
[www.cediacrosspoint.com](http://www.cediacrosspoint.com)

[Home Technology Alliance \(HTA\)](http://www.nahb.org/hta)  
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Questions and Answers



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# CEDIA Professional Offerings within the LEED for Homes point framework

## 1. INNOVATION AND DESIGN PROCESS (ID)

### ID 1: Integrated Project Planning (Up to 4 points)

#### LEED Viewpoint:

It is a great idea for the CEDIA controls/automation expert on the team to participate in this process -- as is true for all the other disciplines. The CEDIA ESC should communicate often and early, with as many of the contributors as possible. If the team isn't already thinking in terms of pursuing a LEED rating, the CEDIA ESC should definitely consider him/herself in the role of green instigator/catalyst and encourage the project team to take that step. Given the financial resources of your clients, there is no significant impediment to greening any project you might be involved with.

### ID 3: Innovative or Regional Design (Up to 3 points)

#### LEED Viewpoint:

There is an ID point available for the incorporation of a home monitoring system such as an AgileWaves dashboard. CEDIA ESC's would definitely benefit by being able to provide defensible hard data about savings attributable to control strategies. It would be challenging to garner more than the 1 point that is already on the table without making a compelling (quantitative) case for the contribution of the automation strategies. Getting this research done should be an organizational priority.

What systems a CEDIA ESC could design in this category:

#### Video Conferencing/Telecommunications

- Environmentally friendly, reduces travel
- Increases efficiency by decreasing travel time
- Paper reduction strategy

#### Audio Visual Systems

- Selection of energy efficient components
- Incorporating parasitic power control devices
- Programming strategies to shut-off components not in use
- Remote access & control
- Consolidation of components at one location
- Implementing heat dissipation & exchange (re-use equipment heat)
- Selection of RoHS and WEEE compliant products
- Heavy metal based infrastructure reduction strategies
- Efficiency-minded installations

#### Security Systems

- Occupancy, motion, perimeter and smoke/heat sensors relay information
- Cross-collateralization (integration with HVAC, Lighting control, Motorized window treatments, monitoring systems)
- Save money, reduce consumption, protect property thru leak detection
- Create a healthier, safer indoor environment

#### Monitoring Systems

- Track, measure and quantify resource and utility consumption
- Monitor system/component performance
- Reduce consumption, reduce costs, reduce environmental impact
- Increase efficiency through instantaneous, actionable feedback
- Provide an optimization tool to further increase system performance
- Provide managed services through sending of reports and recommendations
- Real-time and historical views empower users with insight
- Native integration allows information to be displayed on control system UI

#### 4. WATER EFFICIENCY (WE)

##### WE 2: Irrigation system (Up to 7 points)

##### LEED Viewpoint:

The principal tool here is a "smart" controller, otherwise known as an ET (evapotranspiration) controller, which tracks real-time atmospheric data to determine whether irrigation is needed or not. This is an automation tool that is already being deployed and CEDIA ESC's probably want to be aware of and recommend its use to the project teams if they're not already looking at it. However, I don't see any additional point contribution opportunities from CEDIA folks, per se, as this is generally within the purview of the landscape designer and/or installer. Being knowledgeable about the arsenal is your principal tool here, enhancing your value to the project team through knowledge (as opposed to "delivering points").

What a CEDIA ESC could do in this category:

##### Irrigation, pool & spa Control

- Decrease resource (water) use through "smart" sensing & control
- Decrease costs by reducing energy & water use
- Increase life of components due to more efficient tasking

#### 5. ENERGY AND ATMOSPHERE (EA)

##### Energy and Atmosphere: EA 1, 3, 5, 6, 7, 8, 9 (Up to 20 points)

##### LEED Viewpoint:

The CEDIA ESC needs to develop a control system that has the potential to influence overall energy performance (and thereby earn points). Via automation solutions is probably limited to a point or two at best -- you can't influence insulation (either quantity or installation quality), glazing parameters, air leakage, duct leakage, the intrinsic efficiency of HVAC equipment or water heating equipment, the efficiency of the water distribution layout, the efficacy of luminaires, the intrinsic efficiency of appliances, nor the size or output of the renewable energy systems. CEDIA does have the potential to influence the performance of some of those systems and equipment items in use, amounting to a performance gain of some as-yet-to-be-determined margin. This goes back again to doing some good analysis on what exactly that margin is, and what variables influence it -- i.e., which systems are you controlling, and in what climates, under what usage patterns, etc. Not an easy thing to assess, but doing so convincingly will be central to making your case.

What a CEDIA ESC could do in this category:

#### Lighting Control

- Dimming
- Occupancy sensing
- Global scenes with astronomical clock settings
- Daylight harvesting
- Solar irradiation sensors
- Suggestion of efficient fixtures & bulb types
- Cross collateralization (integration with HVAC, motorized window treatments, Security, monitoring systems)
- Remote access & control
- Increased life expectancy of bulbs
- Decreased costs
- Decreased environmental impact
- RoHS compliant components

#### HVAC Integration

- Programmable Tstats
- Cross collateralization (integration with motorized window treatments, Security, monitoring system, lighting control)
- Remote access & control
- Time-based temperature parameter settings
- Occupancy sensing
- Heat exchange/capture and re-use (ERV, use heat from equipment)

#### Heat Dissipation and Exchange

- Suggest, incorporate ERVs
- Suggest re-use of heat generated by equipment
- Extend life of components through cooler operating temps
- Reduce costs due to component failure and service visits

#### Integration, Cross-collateralization

- Integrating disparate systems with 2-way communication to increase efficiency (ie: shades automatically lowering when room gets too warm, lights automatically dimming as more ambient light enters room, etc.)
- Power calculations on all proposed equipment and strategies to reduce overall consumption (ie: staged-on power supplies, automatic zone shut-offs, etc)
- Approaching overall system programming with an eye to efficiency and consumption reduction strategies

#### Motorized Window Treatments

- Automate for daylight harvesting strategies
- Cross collateralization (integration with HVAC, Security, Lighting control, monitoring systems)
- Selection of low/no VOC & toxic shading materials
- Selection of energy efficient, low footprint systems
- Interior heat mitigation strategies employing shading
- Site orientation considerations
- Extend life of furniture and finishes by decreasing UV exposure
- Reduce costs by reducing need for energy intensive mechanical HVAC
- Use with solar irradiation sensors

Parasitic Power

- Suggest strategies to mitigate parasitic power if in project early
- Switched outlets on lighting control systems
- “smart” power strips/supplies to shut off components
- Reduce costs due to decrease in electrical consumption

EA 10: Renewable Energy (Up to 10 points)

LEED Viewpoint:

One might make the argument that if you designed a controls/automation system to power down all non-essential tasks and building operations during summer afternoons to optimize power production for the grid and then it might be worth a credit. There are a variety of ways to look at this and the powers that be might respond that building occupants have every incentive to do so anyway with such a system. The benefits of providing maximum grid power feedback during mid-late afternoon is that inefficient power plants need to be turned on at peak times to supply peaking power, thus helping to even this overall load on the grid is beneficial both economically, socially, and environmentally.

What a CEDIA ESC could do in this category:

Renewable Energies (solar, wind, etc)

- Integration or even installation of renewable energy technologies (solar PV, wind turbines, fuel/power cells)
- Partnership with companies specializing in renewable energy technologies
- Second party renewable energy technology monitoring systems

6. Materials and Resources (MR)

Efficient utilization of materials, selection of environmentally preferable materials, and minimization of waste during construction. (Up to 3 points)

What a CEDIA ESC could do in this category:

Choosing & Procuring Products

- RoHS & WEEE compliance
- Local sourcing to decrease delivery distance
- Consolidation of orders
- Energy Star (or other certifications) when possible
- Compare energy consumption when on and off
- Use “staged” amps and power supplies when possible
- Low/no VOC & toxic components

Company Internal Business Policies/Strategies

- Fleet of hybrid service vehicles
- Office recycling program
- Encourage employees to use public transport or car-pool
- Use of sustainable, recycled and re-purposed office equipment & supplies.
- Energy efficient light bulbs, low/no VOC paints
- Employee incentives
- Paper-reduction strategies, use of E-files and FTP sites for clients
- Purchase of offsets
- Triple-bottom-line focus

Project Execution Practices

- Clean site-rapid removal of packing materials
- Recycling & disposal of packing materials
- Recycling program for used equipment and components
- Re-use of existing infrastructure as much as possible
- Carry out power calculations on components to be installed
- Waste reduction strategies (ie: less paper plans, wire cut-off awareness, hardware re-use, etc.)

7. Indoor Environmental Quality (EQ)

(Up to 3 points)

LEED Viewpoint:

There is an established LEED mechanism referred to as "exemplary performance with respect to" a given credit. However, USGBC has ruled that no additional points are available for exemplary performance with respect to any of these credits. In order to get them to reverse that position, you would have to make a very, very compelling case and it's hard to imagine how controls strategies for ventilation systems would provide enough measurable, justifiable, improvement in air quality, as compared to the use of the ventilation strategies already outlined in these credits, to warrant additional points.

What a CEDIA ESC could do in this category:

Indoor Air Quality

- Encourage air exchange thru ventilation
- Selection of low/no VOC & toxic components
- Installation of IAQ sensors & monitoring devices
- Quick removal of component packing materials
- Healthier, safer environment for occupants
- Reduced costs due to less medical expenses
- Increased productivity due to better environment

8. AWARENESS AND EDUCATION (AE)

AE 1, 2: Education of Building manager/owner (Up to 3 points)

LEED Viewpoint:

Training on controls systems is required, along with training on all the other systems and equipment in the home. There may be an opportunity for the CEDIA ESC to participate in delivering training or developing training materials. The mandatory training is 1 hour and the optional "enhanced" training is an additional 2 hours. However, when an owner is actively engaged in the design of the green aspects of the home, the optional point is generally awarded more or less automatically in recognition of the owner's ongoing education throughout the process. This means that the CEDIA piece of this (a fraction of 1 hour) is likely quite small and may not be worth the additional effort involved in preparing and delivering it.

## Glossary of Terms

**Amplified Volume Control Systems:** An amplified volume control systems is a single-wire solution that delivers music to multiple rooms via a central control box. Some of these systems make use of CAT 5 cable to deliver the un-amplified audio signal to each room, where an in-wall amplifier and speakers reproduce the music.

**Analog:** In the consumer electronics world, analog technologies are those that use traditional methods of receiving, recording, and/ or reproducing content or communications. Examples of analog technologies include VHS VCRs and cassette tapes.

**Aspect Ratio:** The ratio of the width to the height of an image. Analog television uses a 4:3 or 1:1.33 ratio (slightly rectangular, being wider than it is tall), while digital television uses 16:9 or 1:1.78 (almost twice as wide as it is tall).

**Asymmetric Digital Subscriber Line (ADSL):** A form of DSL broadband service, it is called "asymmetric" because of its two-way bandwidth is devoted to the downstream direction, sending data to the user.

**Audio Distribution Amplifier:** These are amplifiers that distribute the input from a single audio component to multiple audio outputs or locations.

**Bridge:** A bridge is a device that connects two similar networks together to increase the distance or number of devices a given type of network can handle.

**Broadband:** Broadband refers to telecommunication that provides multiple channels of data over a single communications medium. Typical examples of consumer broadband services are high-speed internet delivered via cable, Digital Subscriber Line (DSL) or fiber-optic networks.

**Cable Modem:** A cable modem is a device that enables connection to the internet and sends/ receives data via a local cable TV provider.

**Category 3 Cable (CAT 3 Cable):** Used for medium-speed communications of up to 10 megabits over a distance of up to 100 meters. The FCC has specified that new homes use a minimum of CAT 3 wiring for telephones in new home construction.

**Category 5 Cable (CAT 5 Cable):** Network cabling that consists of four twisted pairs of copper wire terminated by RJ45 connectors and is capable of up to 100 Mbps over distance of up to 100 meters. Commonly used for data and telephone, it is now widely used for distribution of audio signals and is often used in new home construction.

**Category 5 Enhanced Cable (CAT 5(e) Cable):** Supports short-run 1000baseT (1,000 Mbps) networking by utilizing all four wire pairs. CAT 5(e) is backward-compatible with CAT 5 cabling.

**Cathode Ray Tube (CRT):** CRT refers to the traditional glass picture tubes that have been used in analog TVs since their inception. CRTs are also used in some rear-projection TVs.

**Cluster:** A hardware connection between two or more PCs that forms a closed network or internal network for sharing data and processing tasks among connected PCs.

**Coaxial Cable:** Coaxial (coax) wiring is often used to distribute video signals but can also be used for other types of communications. There are several varieties of coax cable used in homes such as RG59 and RG6, the latter of which is recommended for all new wiring for cable and satellite TV.

**Cogeneration (Also known as combined heat and power, CHP):** CHP is the use of a heat engine or a power station to simultaneously generate both electricity and useful heat. It is one of the most common forms of energy recycling.

**Color saturation:** A term to describe how vivid and intense colors in the display appear, independent of brightness. If the color saturation is too low, colors appear washed out, but if the color saturation is too high, colors may appear too vivid.

**Contrast:** The relationship between the lightest and the darkest areas on a display device or picture. A small difference means low contrast and a large difference means high contrast.

**Dedicated Wire:** Wiring that is installed specifically for communications. It includes twisted pair wiring used for Ethernet networks and coax wiring used for cable TV, etc.

**Digital:** Digital describes electronic technology that generates, stores, and processes data in terms of two states: positive and non-positive. Positive is expressed or represented by the number 1 and non-positive by the number 0. Thus, data transmitted or stored with digital technology is expressed as a string of 0's and 1's.

**Digital Video Recorder (DVR):** A video component (set-top box) with an integrated hard drive for recording and time-shifting television programming. DVRs may contain an integrated tuner for receiving cable, over-the-air, satellite and/ or HDTV broadcasts. The most popular example of a DVR is a TiVo. DVR functionality can also be integrated into other devices such as a home computer or television.

**Ethernet:** Ethernet is the most widely-installed local area network (LAN) technology, which uses coaxial cable or special grades of twisted pair of wires.

**Firewall:** Security measures (hardware and/ or software) that blocks unauthorized users from gaining access to a computer or network.

**Graphic User Interface (GUI):** A technology for interfacing with computer software by pointing (mouse) to graphic images (windows, icons, menus) instead of typing text. Apple's Mac Operating System and Microsoft's Windows are the two most popular computer GUIs. On consumer electronics products, GUIs are commonly used to program VCRs and setup video displays via their on-screen menu.

**High Definition Multimedia Interface (HDMI):** A single high-bandwidth cable that can carry both digital audio and video signals from an HDTV receiver, DVD player, etc., to a video display and/ or multi-channel audio receiver/ processor.

**Home automation:** Systems that provide convenient centralized access, usually via keypad or PC, to various controls and appliances within a home. Home automation systems allow for the remote control of such items as lighting, thermostats, locks, pet care, pools and spas, landscape watering, blinds and window treatments, multi-media systems, etc.

**Home Network:** A home network interconnects electronic products and systems, enabling remote access to, and control of, those products and systems, as well as any other available content such as music, video, or data.

**Hush Box:** A hush box is an enclosure around a projector that muffles the noise and typically has an exhaust fan that acts to pull out the heat from the projector to avoid overheating.

**In-ceiling, In-wall, On-wall Speakers:** Speakers can be installed in ceilings, walls, and floors as necessary to blend subtly with room décor. Today's in-wall and in-ceiling speakers are capable of the kind of performance associated with free standing speakers except that they can be flush-mounted or hidden almost anywhere.

**LCD:** A video display technology that uses a liquid crystal display, rather than the traditional picture tube, to display video images. Many of today's flat panel TVs and monitors use LCD technology to achieve a super-thin cabinet design.

**Local Area Network (LAN):** A network of personal computers and peripheral devices configured to share information over a short distance, usually within one home or building.

**Media Server:** A device that stores, organizes, and distributes digital content (audio, video, etc.) to other electronic devices.

**Modem:** Short for modulate/ demodulate, a modem modulates outgoing digital signals from a computer or other digital device to analog signals for a conventional copper twisted pair telephone line and demodulates the incoming analog signal and converts it to a digital signal for the digital device.

**Multi-room audio Distribution:** Multi-room audio refers to any audio system that can distribute sound to speakers in multiple listening areas. In its most basic form, a multi-room audio setup contains a source component, like a CD player or an amplifier and is connected to speakers in at least two different rooms.

**Phantom Load:** Refers to the electric power consumed by electronic appliances while they are switched off or in a standby mode.

**Plasma TV:** A type of flat-panel video display that uses a special gas sandwiched between layers of glass. When the gas is electrically charged, the gas moves into a "plasma" state and illuminates phosphors, which produce a picture.

**Radio Frequency (RF):** RF waves can be transmitted and received through walls and other physical barriers and differs from IR (infrared) technology, which requires a clear line-of-sight between transmitter and receiver.

**Residential Gateway:** A device that allows customers' premise equipment which is connected to in-home networks to access and use services from any external network regardless of media.

**Router:** A device used to connect two networks, and most commonly used in residential applications to connect a home network to the internet.

**Standby Mode:** Refers to a low power mode for electronic devices such as computers, televisions, and remote controlled devices. These modes save significant electrical consumption compared to leaving a device fully on and idle and allow the user to avoid having to reset programming codes or wait for a machine to reboot.

**Sub-system:** Any system in a whole-house system that accepts commands from another system and/ or gives feedback to that system.

**Structured Wiring:** A system of low-voltage wires (not power line) designed to carry electronic signals throughout the home.

**Systems Integrator or Installer:** This specialist works with all the trades in the design and build process to plan, design, program, install, and service low-voltage electronic systems and equipment in the residential market.

**Twisted Pair cabling:** Cable constructed of two braided wires, each with its own dielectric insulation twisted together to form a single cable. The twisting allows the cable to carry higher frequency signals than the cable could otherwise. Most twisted pair cables used in the home such as CAT 3, 4, and 5 include four of these pairs of wires within an outer insulating sheathing. There are two basic types of twisted pair cables: shielded and unshielded. Most applications in the home use unshielded four-pair cable.

**User Interface:** Devices such as volume controls, keypads, and LCD touchscreens that allow control (to varying degrees) of a home's electronic systems. There are a wide variety of user interfaces available and most can be mounted in the wall or are designed for the table-top or counter.

Voice Over IP: Voice telephone service delivered via the internet. A major advantage of VoIP and internet telephony is that it avoids the tolls charged by ordinary telephone service.

Whole-house Network: A whole-house network involves multiple types of cluster networks connected to each other through devices called gateways. This type of network is the most complex but it also provides the most functionality.

Widescreen: Any video software or hardware with an aspect ratio wider than 4:3; usually 16:9, which is the optimum ratio for viewing anamorphic DVDs and HDTV broadcasts.