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Development and Training of a Knowledge-based Workforce for the Intelligent Buildings and Connected Home Industries

A CABA WHITE PAPER

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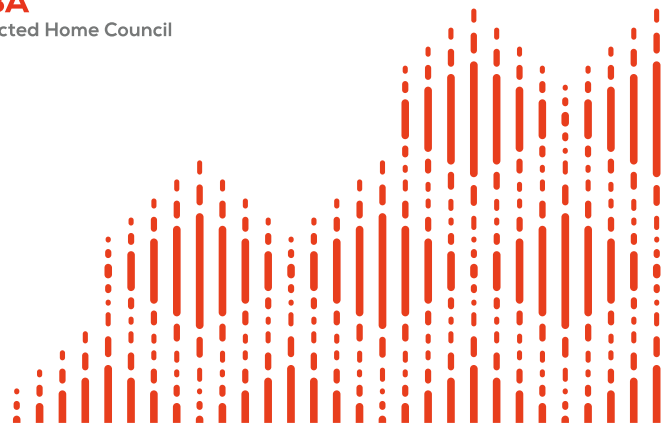
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ABOUT CABA

The Continental Automated Buildings Association (CABA) is an international not-for-profit industry association, founded in 1988, and dedicated to the advancement of intelligent home and intelligent building technologies. The association is supported by an international membership of over 360 organizations involved in the design, manufacture, installation, and retailing of products relating to Internet of Things, M2M, home automation, and intelligent buildings. Public organizations, including utilities and government, are also members. CABA's mandate includes providing its members with networking and market research opportunities. CABA also encourages the development of industry standards and protocols, and leads cross-industry initiatives. CABA's collaborative research scope evolved and expanded into the CABA Research Program, which is directed by the CABA Board of Directors. The CABA Research Program's scope includes white papers and multi-client market research in both the Intelligent Buildings and Smart Home sectors. www.CABA.org

ABOUT CABA'S INTELLIGENT BUILDINGS COUNCIL (IBC)

The CABA Intelligent Buildings Council works to strengthen the large building automation industry through innovative, technology-driven research projects. The Council was established in 2001 by CABA to specifically review opportunities, take strategic action, and monitor initiatives that relate to integrated systems and automation in the large building sector. The Council's projects promote the next generation of intelligent building technologies and incorporate a holistic approach that optimizes building performance and savings. www.CABA.org/ibc

ABOUT CABA'S CONNECTED HOME COUNCIL (CHC)

Established in 2004, the CABA Connected Home Council initiates and reviews projects that relate to connected home and multiple dwelling unit technologies and applications. Connected homes intelligently access wide area network services such as television and radio programming, data and voice communications, life safety and energy management/control information, and distribute them throughout the home for convenient use by consumers. The Council also examines industry opportunities that can accelerate the adoption of new technologies, consumer electronics, and broadband services within the burgeoning connected home market. www.CABA.org/chc

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SECTION 1: INTRODUCTION

It is widely accepted there is a significant shortage of trained professionals in the intelligent building and connected home industries. This white paper addresses this issue and herein the industry is referred to as the "IB/CH industry.

Strengthening collaboration between the IB/CH industry and educational channels is paramount and can be summed up by a quote from Ken Sinclair, AutomatedBuildings.com, "People are our assets, not technology."

Goal and Objectives

Given the rapid growth in building and home automation, there is urgent need for trained and qualified personnel. Educational programs, based in either vocational training or academic instruction in colleges and universities, are relatively new or just emerging and are seeking justification.

Builders, property managers, service providers, and installation companies require people to design and integrate technologies such as networking, communications, lighting, security, fire and safety equipment, audio/video, Heating Ventilation and Air Conditioning (HVAC), air quality monitoring, energy consumption and Programmable Logic Controllers (PLC). They need professional workers familiar with a centralized approach, who can design, control, and manage a building from an interface that provides building-wide efficiency, cost-effective operations, information sharing, and user-friendly control.

IB/CH buildings contribute to, and can participate in, the Smart Grid and Smart City efforts so it is imperative that the educational efforts reflect the changing social, economic, and environmental objectives.

The objectives of this paper are to:

- *Identify the nature and extent of gaps between the building and home automation market needs and existing educational providers*
- *Offer suggestions to fill the above gaps, bridge partnerships and advance alignment between IB/CH industry and educational programs*
- *Enhance alignment of educational programs at all levels of training; vocational, community colleges, and universities, with the IB/CH industry needs*

Target Audience

The intended audiences of this paper include:

- *Educational providers: high school, vocational training centers, community colleges, and universities*
- *Education, certification, and accreditation bodies*
- *Public agencies related to education and training programs*
- *IB/CH industry groups and associations*
- *Employers in the IB/CH industry*
- *Individuals looking to improve their knowledge about building and home automation*

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Scope and Limitations

The purpose of this paper is to provide a snapshot of the IB/CH industry's training needs, share some current initiatives in education, and suggest actions to help meet the needs of workers. In the course of research for this white paper a large amount of relevant information was gathered and is included in the Appendices.

This paper does not compare or rank existing educational program, and/or related practices, but highlights examples to help foster interest and growth in training for the building and home automation industry.

Definitions

Building Automation - the control of energy and resource-using devices in a building for optimization of building system operations. (source: _Building Automation: Control Devices and_ Applications, American Technical Publishers)

Building Automation System (BAS) – refers to the system monitoring and controlling devices inside a building.

Connected Home – term used to describe a residence with integrated/automated systems which allows various subsystems and devices to communicate with each other and with outside services. These may include audio, video, data, energy management, and various control devices and protocols. In recent years the word "smart" has been applied to such things as appliances, cars, and the electrical grid as well. Widespread network connectivity in just about any kind of device (the Internet of Things) has made this concept even more pervasive.

Electronic Systems Technician (EST) – individual who installs, upgrades, and services a variety of residential and commercial electronic systems including audio/video systems, computer networking, lighting, control systems, security and surveillance, telecom, cable and satellite TV, and green technologies such as solar and electric car.

Home Automation – refers to an integrated system in the home capable of functioning without direct human interaction, such as automatically turning on or off lights, sprinklers, or music based on a calendar/time schedule or a trigger event such as the detection of motion or sensing low moisture in the ground.

IoT, Internet of Things – refers to devices connected to the Internet that integrate greater computer capabilities, and use data analytics to extract meaningful information

Net-Zero Energy Building (NZEB) – a building that produces as much energy as it uses when measured at the site. On an annual basis, it produces or consumes as much energy from renewable sources while maintaining an acceptable level of service and functionality. NZEBs can exchange energy with the power grid as long as the net energy balance is zero on an annual basis.

Smart Building – refers to an intelligent space that is operationally more efficient for its owners over the building's lifecycle. A smart building is typically safer and more comfortable for the occupants resulting in increased productivity.

Smart Grid – an electricity supply network that uses digital communications technology to detect and react to local changes in usage.

Smart City – refers to a city that applies new technologies to improve the urban space; interacting with citizens to increase the quality of life. Technology may be applied in different areas such energy, waste, water, telecommunications, policing and emergency response, education and training, transport, health, social services, housing, environmental services, along with finance and economy. It is projected there will be 88 "smart" cities across the globe by 2025, up from 21 cities in 2013.

Smart Home – see Connected Home

STEM - acronym for Science, Technology, Engineering and Math; often used when referring to curriculum and educational policy.

Systems Integration – refers to configuring separate and diverse systems such as audio/video, security, HVAC, access control, and others so they are controlled through one central system or interface, eliminating the clutter of several individual control devices on the wall.

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SECTION 2: INTELLIGENT BUILDING/CONNECTED HOME INDUSTRY LANDSCAPE

With the evolution of smart homes, smart buildings, and smart cities, career opportunities abound given intelligent building construction and implementation of the associated technologies. Consumers and IoT driven lifestyles are driving the market with acceleration. The design, manufacture, and installation of products needed for both intelligent building and smart home automation are exponential. Technology products and services are moving quickly, and there is a strong need for skilled technicians and service providers.

As stated in the *2016 Moving Forward: Findings and Recommendations from the Consultative Council, National Institute of Building Sciences, NIBS, US* [1] "… almost all sectors of the building industry have reported a growing shortage of skilled construction workers – in multiple building disciplines and trades, and across states and regions – **with a dramatic shortage of workers in key industry trades**." The report goes on to say, "The nation cannot afford to wait any longer to change perceptions of vocational and technical schools. Failure to move quickly will result in a continued loss of skilled workers and potentially undo the decades of work spent improving construction techniques and building safety, as on-the-ground expertise and technical knowledge dissipates when the current workforce retires. Government at all levels should do more to encourage trade apprenticeships, internships and on-the-job training." The report hits the nail on the head by pointing out, "Building construction, maintenance and operation are no longer just jobs, they are professions… they require professional development and continuing education."

The proliferation of IoT devices in buildings has caused a dramatic shift from stand-alone building systems to an interconnected system of devices and sensors that have the ability to collect and share data within and across buildings. This has created a large opportunity to increase the efficiency, security, productivity, occupancy comfort and profitability of buildings as relevant IoT data can be analyzed remotely and actionable information can be generated.

It is critical that organizations in the building and IoT value chains have a solid understanding of the current state and future direction of the IoT market, as this market is projected by Memoori Business Intelligence Ltd to reach US$76 billion by 2020.

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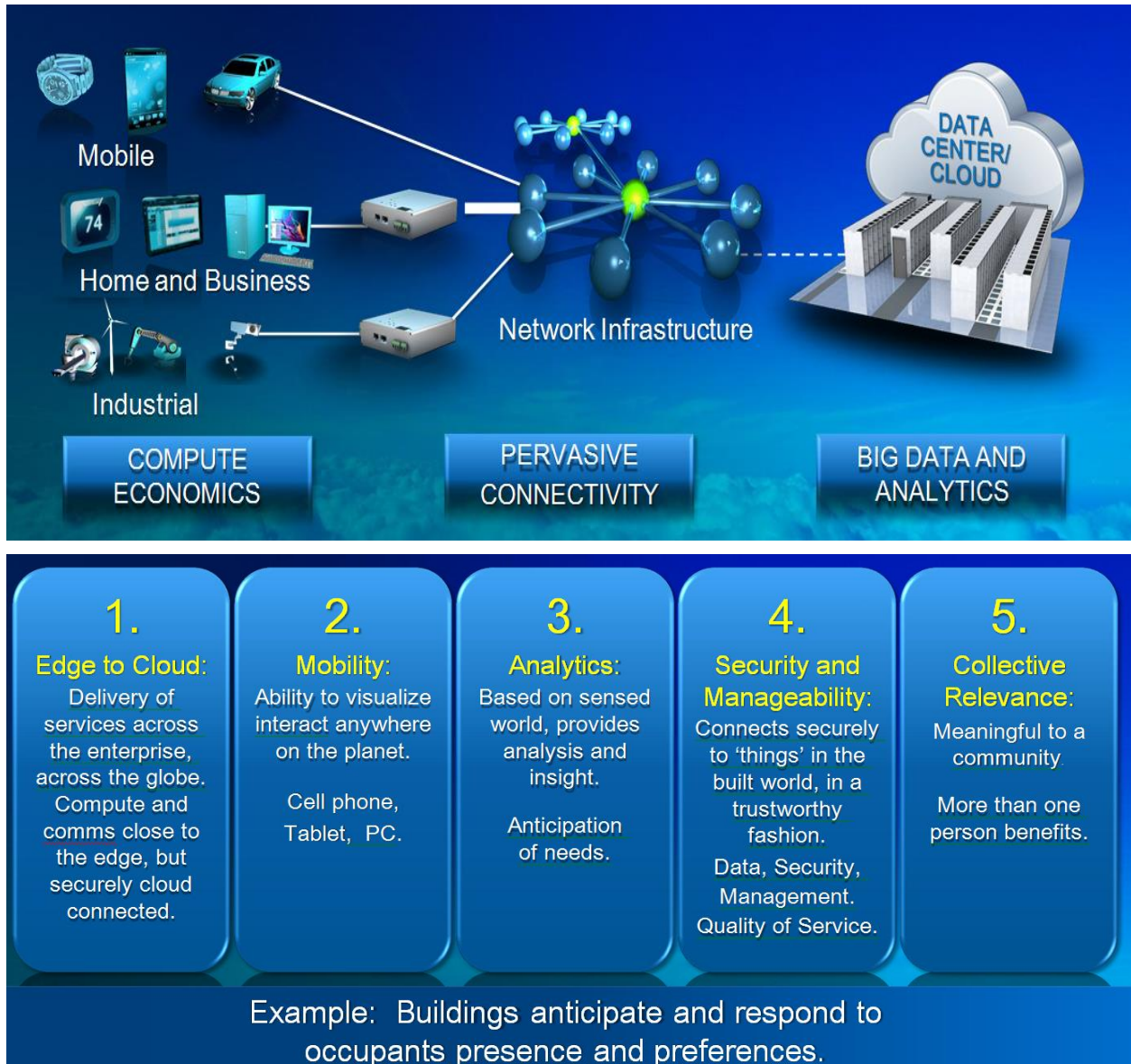
Source: Intel Corporation, 2016, CABA Board Member

Market for Trained Professionals

New technologies are creating new jobs and careers. Training is needed in STEM-related fields, even starting at the K-12 level. Technologies in need of qualified personnel include:

- Intelligent buildings
- Smart and connected homes
- Sustainable technologies
- Photovoltaic and wind energy
- Energy monitoring and management

- Electric vehicle
- Security and alarm
- HVAC integration
- Networking
- IoT security

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Intelligent grid, building and cities

Converged network

Integration with smart grid

Wireless network

Renewable energy technology

Advanced analytics

Smart meters

Enterprise and real-time data access, remote control

Centralized management

Building systems and controls

Rapid deployment of open protocols

| Early Development 1990-2009 | Growth Phase 2010-2015 | Peak 2016-2025 | Maturity 2025-Beyond |

Source: Frost & Sullivan

To meet the demand for a trained and qualified workforce, the number of students and instructors at educational and training initiatives need to be expanded and revised to recruit and retain student employees qualified to do this type of work.

Source: CABA's Smart Grid Impact on Intelligent Buildings
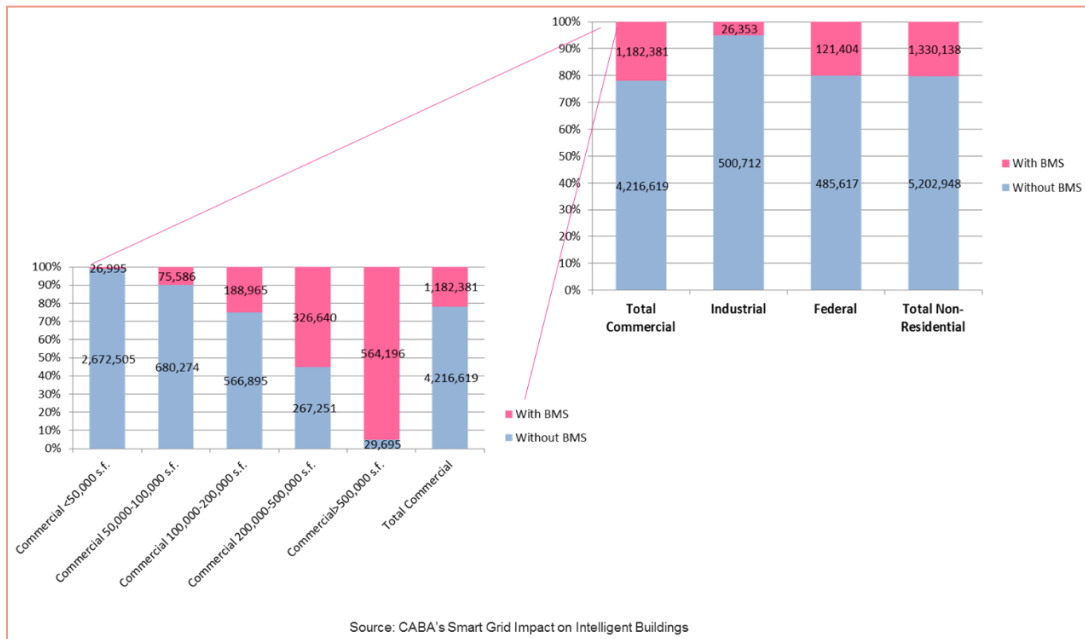
Surveys, meetings, and focus groups conducted by British Columbia Institute of Technology identified demand for individuals with complementary skills in both building controls and energy management, but rarely are these found as a complementary skill set. Professionals are needed by engineering design and commissioning firms, construction businesses, facilities management and operations companies, real estate and property management companies, and control companies.

In the residential market, key indicators for the industry emphasize the many opportunities and strong growth creating demand for a trained workforce;

- *Growth in construction drives growth in electronic systems. Housing starts are estimated to be 1.2 million in 2016, the highest since before the recession. [2]*
- *Overall installed home technologies are annually around $20 billion. [3]*
- *Residential technologies are seeing the fastest growth worldwide. U.S. is leading the way, where smart home revenues are expected to triple by 2021. [4]*
- *In each of the last two years, both commercial and residential integrators reported that they expect their staffing to increase an average of 14% per year. [3, 5]*
- *Most commercial integrators will be awarding pay increases of 5-8% across the board this year, the highest increases reported since 2005. [5]*
- *Residential integrators report higher compensation increases, averaging 10% from 2013 to 2015. [3, 6]*
- *The average annual base compensation for an experienced Electronic Systems Technician (EST) in both residential and commercial work is $44,000 to $48,000, and most are seeing a lot of overtime as well as incentive pay. [3, 5]*

SECTION 3: EDUCATION AND TRAINING OPTIONS

The ways to acquire education and training in preparation for a career in building automation and the connected home industries are as diverse as the systems, career paths, and business models found in this broad industry category. Unlike some career paths such as radiologist or automotive repair technician, few well-defined programs exist that directly correspond to a particular job description in the IB/CH industries.

There are training options both within the academic channel and outside of it, *see Figure 1*. This is because many technicians, programmers, and even system designers may actually start as entry-level technicians and gain knowledge and experience on the job, leading them to higher level positions without formal academic degrees.

The Nature of Associations

An industry association, can also be known as an industry trade group, business association, or industry body. These are organizations founded and formed to unite and inform people who work or are tied to the same occupation or specific industry, in this instance, the intelligent building and connected home industries. Many are not-for-profit organizations governed by bylaws and directed by officers who are also members, to promote those common interests and to further the connected home profession, the interests of the individuals engaged in that profession and the public interest with their common purpose and formal structure. Some associations also provide entry level or other levels of industry training and certification.

See Appendix D for IB/CH Industry Training Resources and Appendix E for Examples of IB/CH Industry Education.

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TRAINING and EDUCATION Serving the INTELLIGENT BUILDING and CONNECTED HOME INDUSTRIES

1. Academic Channels

		Notes	*Focus*	*Areas Taught*	*Credentials*
a.	**Public & Private High Schools**		STEM and College Prep	Math, Physics, Core Curriculum	HS Diploma
b.	**High School Career Centers**	Directed to those not heading to college	Skilled Trades, Dual Credit, Robotics	Electronics, IT, Construction, Graphics	HS Diploma Industry Certifications
c.	**Post-Secondary Trade and Technical Schools**	1 year for Certificate 2 years for Associates Degree	Skilled Trades, Hands-on	Electronics, IT, Audio, Video, Project Management	Industry Certifications, Associates Degree
d.	**Community Colleges and Universities**	1 to 4 years depending on the program	Numerous programs offered	IT, Electronics, Computer Science, Programming, Engineering	Industry Certifications, Associate and Bachelor Degrees
e.	**University Graduate Programs**	1 year and above	Numerous programs offered	Architecture, Electrical Engineering	Masters Degree and PhD

2. Non-Academic Channels

a.	**Industry Associations**	Live - classroom Live - hands-on Online	Entry-level and those already in the industry	Industry-specific Knowledge and Skills, Best Practices, Emerging Trends	Industry certifications
b.	**Manufacturer Training**	Live - classroom Live - hands-on Online	Technologies and techniques specific to products	Sales, Design, Installation, Troubleshooting, Applications	Manufacturer Credentials
c.	**Independent Training Companies**	Live - classroom Live - hands-on Online	Entry-level and those already in the industry	Fundamentals, Calibration, Project management	Certificate of Completion, Industry certifications
d.	**Self-Study**	Books Online	Entry-level and those already in the industry	All levels	May be pointed to industry certifications
e.	**Military**	Military service provides discipline	Skills learned dependent on position and/or responsibilities	IT, Electronics, Radio Frequency, Programming, Project Mgmt. and more	Rank and honorable discharge
f.	**Workforce Agencies**	May not do training but contract with schools or other entities	Help displaced workers find employment	Basic Electronic Systems or IT	Based on training received

Figure 1: Training Education Options in the United States and Canada

Academic Channels

The academic education channels cover a broad range of topics that are relevant to the IB/CH industry.

Public and Private High Schools – Students are prepared for careers in technology through the study of math and science at all grade levels. In high school, an emphasis on STEM curriculum (Science, Technology, Engineering, and Math) provides the foundation for virtually all areas of technology and innovation.

High School Career Centers – These specialized schools offer training aimed at immediate employment after high school with marketable skills that can provide a living wage and a gateway to success in a wide variety of careers. Career centers offering programs in electronics, robotics, computer tech, and IT will serve both and those likely to go to work directly after graduation and college-bound students. These schools play a key role in preparing entry-level technicians for success on the job, and often offer recognized certifications to verify the student's mastery of a specific body of knowledge.

Post-Secondary Trade and Technical Schools – These schools, both public and for-profit, offer more comprehensive training and certification providing the student with a stronger skill set to take into the workforce. Programs range from one to four semesters.

Community Colleges and Universities – These schools offer even deeper, and more advanced, education in architecture, electronics, computer science, mechanical technology (including HVAC), engineering technology, project management, and more. Degrees range from certificate programs to associate and bachelor degrees requiring from 1 to 4 years depending on the program.

University Graduate Programs – These schools and programs vary depending on the specific program. Engineering programs can cover control systems, some automation, and building systems. Other graduate level programs may focus more on research related to controls and automation systems as well as advanced buildings. Program length starts at one year.

Non-Academic Channels

The non-academic channels are diverse and range from industry associations to private companies.

Industry Associations – the most widely recognized and comprehensive training available outside of public, private, and for-profit schools is offered by the major industry trade associations, such as ESPA, CEDIA, and InfoComm/AVIXA. Training ranges from introductory to very advanced, and is almost always brand-neutral. Associations may offer and administer industry certifications at various levels, which are either gateway (no renewal) or professional (renewable through continuing education credits).

Manufacturer Training – To assist in learning their products, manufacturers offer training direct to individuals at their facilities and through distributors or rep firms. Manufacturer training is beneficial because it is specific to the actual equipment used on projects, and covers the product knowledge needed in the field.

Independent Training Companies – Training is available from for-profit training companies who specialize in fast-track sessions aimed at a specific skill or credential. They may offer live, online, and hands-on training offering a flexible choice for the independent learner.

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Self-Study – The independent learner can gain knowledge and successfully prepare for some industry certifications using books and online resources. This option typically lacks the hands-on activities included in a more formal training environment, but a candidate may still be able to earn certifications in networking, electronic systems, and other specific topics by studying books and taking online courses.

Military –Valuable skills can be gained in military service, especially in IT, electronics, radio frequency, and project management. The knowledge and experience gained, along with the discipline of military service, benefit veterans as they re-enter the civilian workforce and consider opportunities in the IB/CH industry.

Workforce Agencies – In most states and provinces, as well as some municipalities, there are government agencies specializing in finding employment for those who have been displaced from jobs, are underemployed, or just want a career change. These agencies typically don't do the actual re-training, but frequently contract schools or other entities to deliver job-specific training. This is usually in the areas of basic electronic systems work or IT.

Education Collaboration Example

Over 60 independent schools in the United States are working together under the BEST Center, Building Efficiency for a Sustainable Tomorrow. Sponsored by the National Science Foundation's Advanced Technological Education program, this national collaboration supports faculty professional development and advanced educational programs in commercial heating, ventilation, air conditioning, building automation, and energy management.
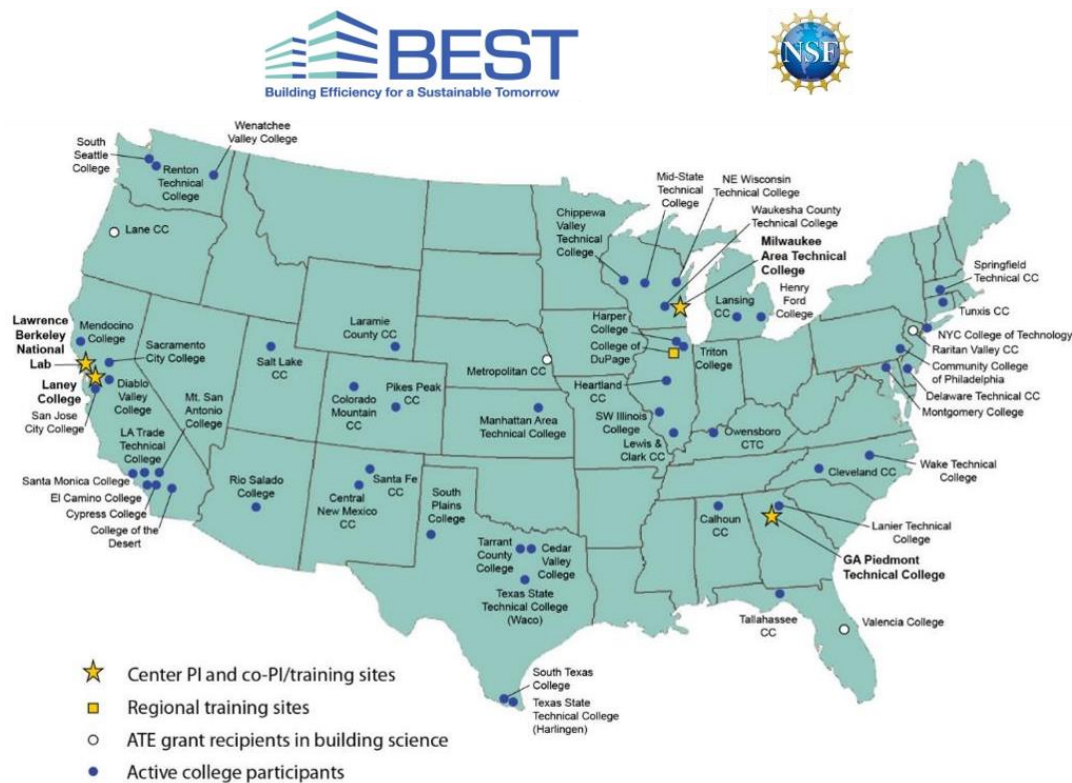
Map of BEST Center College Network (58 members)

Accreditations and Certifications

The credentials, certifications, and degrees applicable to the IB/CH industry are as diverse as the industry itself. On-the-job training and orientation are often necessary due to the many specialized technologies and concepts. Unlike other standardized career paths such as computer networking or radiology, the actual work done in the IB/CH industry varies greatly from employer to employer and project to project. Here is a summary of typical credentials which may be recognized by employers in this sector.

- *High School Diploma or Graduation Equivalency Diploma, GED*
- *High School Diploma (Career Center, Focus on Technology)*
  Example; Electronics or Computer Tech program which includes curriculum pointing to the electronic systems industry, IT, automation, or robotics.
- *Diploma/Advanced Diploma program (Accredited Tech School, Community College)*
  Examples; Post-secondary tech school or community college non-degree program lasting 1-2 years; in Canada, Advanced Diploma programs often lasting 3 years. Diplomas can earn credits towards a degree.
- *Certificate Program (Accredited Tech School, Community College)*
  Example; Post-secondary tech school or community college non-degree program that lasts 1-2 years (similar to a diploma); certificates are for-credit and can count towards an associate's degree.
- *Associates Degree (Tech School, Community College, or University)*
  Examples; Typical two-year degree, including general required knowledge courses. May be in Electronic Technology, IT, HVAC, Building Automation, Project Management, or other related fields.
- *Bachelor's Degree (4-year College or University)*
  Examples; Typical four-year degree such Computer Science, Electronics Technology, Mechanical Engineering, Electrical Engineering, Architecture.
- *Graduate Degree (Engineering, Architecture, Electrical Engineering, IT etc.)*
  Examples; Post-Grad degrees in Computer Science, Mechanical Engineering, Electrical Engineering, Architecture
- *Certificate of Course Completion (School or Online)*
  Examples; Post-secondary tech school offering short-term training but not a Degree or Industry Certification, or online classes which require passing assessments to finish course and receive certificate.
- *Industry Association Certification (Self-study or at a School)*
  Examples; Earning Recognized Industry Certification such as ESPA, CompTIA, CEDIA, InfoComm/AVIXA, or ISA either through self-study, online classes, fast-track training, or at a school.

Summary

As shown here, there are many ways to acquire skills related to the IB/CH industry. With the recent introduction and growth of the IB/CH industries, new employment opportunities are appearing and career paths are still being defined. With the general lack of awareness of what the industry does and what skills are needed, few institutions have programs aimed specifically at the IB/CH industry, but educational offerings are expanding with new programs, accreditations, and certifications, though curriculums vary greatly.

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SECTION 4: CURRENT IB/CH INDUSTRY EDUCATION AND TRAINING

Existing training programs are expanding, and new training programs for professionals are emerging with the growing awareness of career opportunities in the IB/CH industry. Educational opportunities are diverse, ranging from accredited academic schools to independent training companies.

Several training and education resources, <u>but by no means a complete list</u>, are listed in Appendix D. Further information on some of these academic/education opportunities can be found in Appendix E and are listed in the following summary table for reference.

Industry associations offer training for their members and non-members are listed in Appendix A.

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#	Institution	Delivery			Target Audience														Focus Areas					Credentials						Length	Website
		Live Classroom	Virtual Classroom	Online Independent Study	High School	HS Grads	Open Enrollment	Trade/Vocational	Career Changers	STEM / College Prep	College	Post Graduate	Continuing Education	Veterans/Military	Workforce Retraining	Displaced Workers	Instructors	Existing Workforce	Commercial Application	Energy Management	Basic Principles	Residential/Homes	Programming	Diplom /Advanced Diploma	College Certificate Program	Associates Degree	Bachelor's Degree	Certificate of Completion	Industry Assoc. Certification		
1	AEE – Association of Energy Engineers	X	X	X										X			X		X	X		X							X	8-12 weeks course, 48 hours total plus labs	https://www.aeecenter.org/i4a/pages/
2	Algonquin College	X									X								X		X		X							3rd yr elective course, school year calendar	https://www.algonquincollege.com
3	APT College	X	X															X	X	X	X						X	X			Varies, open only to industry personnel	www.aptc.edu
4	Barry Tech Career and Tech Education Center	X			X			X		X			X							X	X	X							X	1-2 years for HS juniors or seniors	https://www.nassauboces.org/Page/4498
5	British Columbia Institute of Technology			X				X			X		X	X					X	X	X			X						3 Years – 6 Semesters, Post-Secondary program	http://www.bcit.ca/bcem
6	Canadian Institute for Energy Training	X	X	X									X				X		X	X									X	Short-term trainings for professionals	www.cietcanada.com
7	Central Nine Career Center Adult Education	X							X										X		X	X							X	10 weeks - 2 nights a week	http://central9.k12.in.us/
8	College of DuPage - Building Automation	X			X	X	X	X	X	X	X	X		X				X		X	X	X	X			X				1-year community college certificate	http://cod.edu/programs/hvacr/
9	College of the Desert	X			?	X	X	X	X	?	X	X	X	X			X		X	X	X	X	X			X	X		X	Certificates and 2-year degree program	www.COD2Careers.com collegeofthedesert.edu
10	ETA - International	X		X				X	X	X	X				X	X	X		X	X	X	X							X	Preparation varies for certification exam	www.eta-i.org
11	George Brown College	X						X	X	X									X	X	X	X	X	X						3 Years – 6 Semesters Post-Secondary program	http://www.georgebrown.ca/T171-2015-2016/ Code=programgroup&ProgramGroupID=37
12	Georgia Piedmont Technical College	X	X		X	X	X	X	X	X	X	X		X				X	X	X			X	X						2-year diploma and degree	
13	Heartland Community College	X				X	X	X	X		X	X		X				X	X	X					X					Varies depending on program	http://www.heartland.edu/catalog/industrial
14	InfoComm AVIXA - Ben Franklin Inst of Tech	X			X	X		X	X	X	X	X		X				X		X					X					2-year computer technology w/ A/V track	http://www.bfit.edu/our-programs/computer-technology/av-technology/av-technology
15	InfoComm AVIXA - City College San Francisco & Laney College	X			X	X	X	X	X	X	X	X		X	X	X		X	X		X					X				To be offered in 2018	https://www.ccsf.edu/

CABA
Intelligent Buildings Council

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CABA
Connected Home Council

#	Institution	Live Classroom	Virtual Classroom	Online Independent Study	High School	HS Grads	Open Enrollment	Trade/Vocational	Career Changers	STEM / College Prep	College	Post Graduate	Continuing Education	Veterans/Military	Workforce Retraining	Displaced Workers	Instructors	Existing Workforce	Commercial Application	Energy Management	Basic Principles	Residential/Homes	Programming	Diplom /Advanced Diploma	College Certificate Program	Associates Degree	Bachelor's Degree	Certificate of Completion	Industry Assoc. Certification	Length	Website
		Delivery			Target Audience														Focus Areas					Credentials							
16	InfoComm AVIXA - Columbia College	X			X	X					X	X							X		X	X					X			4-year degree options in Audio Arts & Acoustics	http://www.colum.edu/
17	InfoComm AVIXA - Full Sail University	X			X	X			X	X	X	X		X					X		X						X		X	20-month degree in Show Production	https://www.fullsail.edu/degrees/show-production-bachelor
19	InfoComm AVIXA - Sheffield Inst Record Arts	X			X	X			X	X	X	X		X			X	X	X		X	X						X		Full-time 27-30 weeks	http://www.sheffieldav.com/education/courses/techworks
18	InfoComm AVIXA - Valencia College	X			X	X	X	X	X	X	X	X		X			X	X	X		X					X	X			2-year program in Entertainment Design & Technology	http://catalog.valenciacollege.edu/degrees/associateinscience/artsentertainment/entertainmentdesigntechnology/
20	Laney College - Building Automation Systems	X			X	X	X	X	X	X	X	X		X			X	X	X	X	X		X			X	X			2-year certificate and degree	http://laney.edu/ect/ect-building-automation/
21	Lincoln Technical Institute	X				X			X					X							X	X						X		11-months/ NCCER certificate	http://www.lincolntech-usa.com/index.php
22	LonMark Building Automation Program		X	X			X	X	X				X	X	X		X	X	X		X		X						X	20-30 hours; 6 hours Refresher Course	http://www.lonmark.org/training https://test.lonmark.org
23	Maverick Technical Institute	X				X															X	X	X						X	10-months/ESPA & CEDIA certifications	http://mti.school/
24	Milwaukee Area Technical College	X			X	X	X	X	X	X	X	X		X			X	X	X	X	X		X	X						1-year community college diploma	http://www.matc.edu/tas/diplomas/automated-building-systems.cfm
25	Mt. San Antonio College	X			X	X	X	X	X	X	X	X		X			X	X	X	X	X		X			X	X			2-3 semester certificate and degree	http://mtsac.edu/buildingautomation/
26	Orange Technical College	X			X	X					X		X						X		X	X							X	One semester elective to be offered in 2018	https://www.orangetechcollege.net/
27	ProMedia	X			X				X					X		X				X	X	X							X	5-day courses	http://www.promediatraining.com/
28	Seneca College - MBT	X			X			X			X						X	X	X	X	X			X						3-yr full-time program	http://www.senecacollege.ca/fulltime/MBT.html
29	Wharton County Junior College	X				X					X						X	X	X		X					X	X				www.wcjc.edu/programs

SECTION 5: OPPORTUNITIES AND SUGGESTIONS

Through the research and work on this White Paper, numerous ideas and suggestions occurred to feed the industry with qualified workers and align training channels with today's IB/CH industry.

By "sharing the story," the industry can help close the skills gap and help build the workforce of next-generation automation and process control professionals in the IB/CH industry markets.

OVERALL Suggestions
- *Strengthen collaboration between the industry and training providers*
- *Develop partnerships between the industry and training providers*
- *Promote public knowledge of the IB/CH industry and the diverse career opportunities*

DEVELOP Information to Share
- *Identify specific career paths within industry segments, positions/titles, responsibilities, and pay range*
- *Create a standard set of learning objectives, foundational principles, and operational best practices for a knowledge-based workforce*
- *Identify the current number of building control technicians in the U.S. and Canada*
- *Perform a workforce gap analysis*

OUTREACH to Academic and Other Training Channels
- *Engage IB/CH industry professionals on academic advisory boards*
- *Emphasize STEM curriculum and raise awareness of building and residential automation industries*
- *Increase awareness and focus of electronics and IT training on career opportunities*
- *Encourage HVAC, electronics, and IT training programs to also educate about building systems and cultivate systems-level thinking by sharing and aligning curriculum*
- *Promote online delivery methods for teaching foundational skills and make this training readily available to as many interested parties and students as possible to prepare for hands-on learning*
- *Ensure training incorporates the knowledge needed in all phases of a building's life; design, construction, commissioning, and ongoing operation*
- *Promote professional development with training offerings to intermediate School District regions and community college instructors*

ACTIONS for the Industry
- *Develop a plan for outreach and marketing around careers in the IB/CH industries*
- *Educate and promote how intelligent buildings can support energy conservation*
- *Manufacturers work with industry associations to raise awareness of career opportunities*
- *Manufacturers direct people to foundational training offered by trade associations and emphasize the critical importance of network skills*
- *Build a coalition of industry stakeholders to address training needs specific to intelligent building control and keep up with changing technology*
- *Engage with military, government, and workforce agencies to promote awareness of career opportunities*
- *Create co-op opportunities, internships, and apprenticeship programs*
- *Create outreach program for prospective K-12 students for after school programs and competitions to further the student education and interest in employment and careers in the IB/CH industries*
- *Build awareness of workforce grants for employee re-training and facilitate access to them*

APPENDIX A: ASSOCIATIONS

AEE – Association of Energy Engineers
Association providing information and networking in the dynamic fields of energy engineering, energy management, renewables, power generation, energy services, sustainability, and related areas. Membership includes over 18,000 professionals in more than 100 countries is widely recognized energy certification programs.
www.aeecenter.org

AIA – The American Institute of Architects
An industry association with over 90,000 members that advocates the value of architecture and provides architects the resources they need to do their best work.
www.aia.org

ASHRAE – American Society of Heating Refrigeration and Air Conditioning Engineers – an industry association focuses on all things related to buildings
www.ashrae.org

ATE – Advanced Technological Education
The National Science Foundation's Advanced Technological Education (ATE) program supports the development of innovative approaches for educating highly skilled technicians for the industries that drive the nation's economy.
www.atecenters.org

BACnet International
BACnet International is an industry association that facilitates the successful use of the BACnet protocol in building automation and control systems through interoperability testing, educational programs and promotional activities.
www.bacnetinternational.org/page/the_bacnet_institute

CABA - Continental Automated Buildings Association
An international not-for-profit industry association dedicated to the advancement of intelligent home and intelligent building technologies.
www.CABA.org

CEDIA – Custom Electronic Design and Installation Association
Serves the residential systems industry with events, training, certification, standards, and member services. ESC, ESC-T, ESC-D, and ESC-N certifications.
www.cedia.net – industry site for members and other industry professionals
www.cedia.org – out-facing site for architects, builders, homeowners, and the press

CompTIA – Computer Technology Industry Association
Serves and promotes the IT industry through standards, publications, training, and certifications.
www.comptia.org

CSI - The Construction Specifications Institute
A national association of more than 9,500 professionals dedicated to improving the communication and construction information. Members are experts in building construction and the materials used therein.
www.csinet.org

CTA – Consumer Technology Association
Serves the consumer electronics industry with the largest trade show of its kind, standards, and government affairs.
www.cta.tech

ESA – Electronic Security Association
Serves the alarm and security industry through government advocacy, training, member services, etc.
www.esaweb.org

ESPA – Electronic Systems Professional Alliance
Training and certification for entry-level technicians. US only. ESPA Certified EST credential.
www.espa.org

ETA – Electrical Training Alliance
Affiliated with IBEW and NECA, the electrical training Alliance provides education materials for the electrical industry. Services include instructor training resources, regionalized curriculum, and advanced learning technologies.
www.electricaltrainingalliance.org

ETA-I – Electronic Technicians Association International
A not-for-profit association supporting the technical professional through vocational and education curriculums, books, publications, certification programs, conferences, speaking engagements, and businesses' resource initiatives.
www.eta-i.org

IBEW – International Brotherhood of Electrical Workers
The IBEW represents approximately 750,000 active members and retirees in the U.S. and Canada working in a variety of fields, including utilities, construction, telecommunications, broadcasting, manufacturing, railroads, and government. As union members, IBEW bargains collectively with employers over wages, benefits, and rights.
www.ibew.org

infoComm International / AVIXA
Serves the commercial systems industry with events, training, certification, and standards. CTS, CTS-I and CTS-D certifications.
www.infocomm.org   www.avixa.org

ISA – International Society of Automation
Founded in 1945, the International Society of Automation is a leading, global, non-profit organization with more than 40,000 members worldwide. ISA develops standards, certifies industry professionals, provides education and training, publishes books and technical articles, and hosts conferences and exhibitions for automation professionals
www.isa.org
https://www.isa.org/participate-in-a-technical-division/building-automation-systems-division/

NACTEL – National Coalition for Telecommunications Education & Learning
The National Coalition for Telecommunications Education & Learning (NACTEL) is a 501 (c)(3) non-profit corporation. Members of the NACTEL Executive Board of Directors include telecommunication employers and labor unions representing employees in the industry.
www.nactel.org

NAHB – National Association of Home Builders
NAHB strives to protect the American Dream of housing opportunities for all, by supporting its more than 140,000 members who build communities, create jobs and strengthen our economy. About one-third are home builders and remodelers and the rest work in closely related specialties such as business services, finance, manufacturing and supplying building materials.
www.nahb.org

NECA – National Electrical Contractors Association
NECA represents the entire electrical contracting industry that brings power, light and communication technology to buildings and communities across the U.S. with innovative research, performance standards progressive labor relations, and workforce recruiting and training.
www.necanet.org

NSCA - National Systems Contractors Association
Serves the commercial systems industry through events and resources aimed at business owners and management.
www.nsca.org

QUEST - Quality Urban Energy Systems of Tomorrow
A non-profit organization that conducts research, engagement and advocacy to advance Smart Energy Communities in Canada.
www.questcanada.org

APPENDIX B: PUBLICATIONS

American School and University

www.asumag.com

Appliance Design

www.appliancedesign.com

ASHRAE Journal

www.ashrae.org/resources--publications/periodicals/ashrae-journal

BACnet International Journal

www.bacnetinternational.org/page/journal

CABA iHomes and Buildings Magazine

www.CABA.org/CABA/News/Magazine/CABA/Resources/Magazine_iHomesandBuildings.aspx

CE Pro

www.cepro.com

Commercial Integrator

www.commercialintegrator.com

Consulting Specifying Engineer

www.csemag.com

Contracting Business

www.contractingbusiness.com

Contractor:

www.contractormag.com

Control Engineering

www.controleng.com

CTA Publications

www.cta.tech/News/Annual-Publications.aspx

EC&M

www.ecmweb.com

Electrical Contractor

www.ecmag.com

Engineered Systems

www.esmagazine.com

HPAC Engineering

www.hpac.com

HVAC Talk

hvac-talk.com/vbb

IoT for Engineers

www.cfemedia.com/iiot-for-engineers

Innovation & Tech Today

www.innotechtoday.com

ISA – Building Controls

www.isa.org/standards-publications

LonMark Magazine

www.lonmark.org/news_events/Magazine

Mission Critical

www.missioncriticalmagazine.com

Oil & Gas Engineering

www.oilandgaseng.com

Plant Engineering

www.plantengineering.com

PM Engineer

www.pmengineer.com

Pure Power

www.csemag.com/PurePower

Realcomm Edge Magazine

realcomm.com/realcomm-edge

Residential Systems

www.residentialsystems.com

SDM, Security, Distributing and Marketing

www.sdmmag.com

Security Dealer & Integrator

www.securityinfowatch.com

Security Sales & Integration

www.securitysales.com

Security Technology Executive

www.securityinfowatch.com

Security

www.securitymagazine.com

Smart Home

www.sdmmag.com

Systems Contractor News

www.avnetwork.com

Technology Integrator

www.technologyintegrator.net

The Air Conditioning, Heating & Refrigeration News

www.achrnews.com

The Retail Observer

www.retailobserver.com

APPENDIX C: INDUSTRY RESEARCH SOURCES

Numerous firms provide research on different areas of the building and home automation industry. Many also offer educational programs aligned with their research programs and make executive summaries and white papers available.

Argus Insights, Inc.: www.argusinsights.com

BSRIA: www.bsiria.co.uk

Continental Automated Buildings Association, CABA: www.CABA.org

Compass Intelligence, LLC : www.compassintellingence.com

EPRI, Electric Power Research Institute: www.epri.com

Frost and Sullivan: www.frost.com

Harbor Research, Inc.: www.harborresearch.com

IHS Markit: www.ihs.com

James Brehm & Associates: www.jbrehm.com

Ken Wacks Associates: www.kenwacks.com

Lux Research Inc.: www.luxresearchinc.com

Machina Research: www.machinaresearch.com

National Institute of Building Sciences, NIBS: www.nibs.org

National Research Council Canada, NRC: www.nrc-cnrc.gc.ca

Navigant Research: www.navigant.com

New Buildings Institute, NBI: www.newbuildings.org

NGL Nordicity Group Ltd.: www.nordicity.com

Parks Associates: www.parksassociates.com

POCO Labs: www.pocolabs.com

Research into Action: www.researchintoaction.com

Strategy Analytics, Inc.: www.strategyanalytics.com

APPENDIX D: IB/CH INDUSTRY TRAINING RESOURCES

AEE – Association of Energy Engineers
See Detailed Listing in Appendix E: Examples of Industry Education and Training

Algonquin College
See Detailed Listing in Appendix E: Examples of Industry Education and Training

APT College
See Detailed Listing in Appendix E: Examples of Industry Education and Training

ASHRAE – American Society of Heating Refrigeration and Air Conditioning Engineers
This industry association focuses on large buildings and provides hundreds of educational programs to their members on all things related to buildings.
www.ashrae.org
https://www.ashrae.org/education-certification

Automated Buildings
An online magazine and web resource that provides the news and connection to the community of change agents creating smart, intelligent, integrated, connected, green, and converged large buildings.
www.automatedbuildings.com

Automated Logic's EIKON for Educators
A version of Eikon LogicBuilder for Educators is available free of charge to educators, consulting engineers, and other professionals who want to use one of the industry's most powerful control system design tool.
http://eikonforeducators.automatedlogic.com/eikon.nsf/605a21551bf892ac852573a80071d6ba/3029d4e39e29c5f5852574e9006b852e?OpenDocument

Barry Career and Technical Education Center
See Detailed Listing in Appendix E: Examples of Industry Education and Training

Bedrock Learning
Dedicated to the connected and smart home, Bedrock offers online courses based on the technologies behind the products to build a solid knowledge foundation for technicians, designers, sales personnel, and anyone interested in learning about the industry.
www.bedrocklearning.com

BEST Center, Building Efficiency for a Sustainable Tomorrow
Located at Laney College in Oakland, California, BEST Center promotes better building performance through the advancement of building science and technician education. Sponsored by National Science Foundation's Advanced Technological Education program, this national collaboration encompasses over 60 two-year community and technical colleges, plus universities and industry partners. Together, they support faculty professional development and advanced educational programs in commercial heating, ventilation, air conditioning, building automation, and energy management.
www.bestctr.org

BOMA Canada
A non-profit association of property owners and managers in the commercial real estate industry. In cooperation with BOMI Canada, BOMA Canada has an initiative to develop a *Building Operator Certification* program.
www.bomacanada.ca/
http://bomacanada.ca/education/

BOMI Canada
An educational institute that provides training for property and facility managers offering designations and certifications for property management, facility management, and building operators.
https://www.bomicanada.com/

British Columbia Institute of Technology
See Detailed Listing in Appendix E: Examples of Industry Education and Training

CareerOneStop

The flagship career, training, and job search website for the U.S. Department of Labor. The website serves job seekers, businesses, students, and career advisors with a variety of free online tools, information and resources.

https://www.careeronestop.org/

Central Nine Career Center Adult Education

See Detailed Listing in Appendix E: Examples of Industry Education and Training

CIET – Canadian Institute for Energy

See Detailed Listing in Appendix E: Examples of Industry Education and Training

College of DuPage

See Detailed Listing in Appendix E: Examples of Industry Education and Training

Lab tour: https://www.youtube.com/watch?v=YKkB1AvpVqg&t=212s

College of the Desert

The Building and Energy Systems Professional (BESP), Associate of Science Degree offers students a broad overview into the energy efficiency, green technology, and building science industry and includes cross disciplinary courses in Energy Conservation Methods, Renewable Energy (generation and storage), Energy Systems, Heating Ventilation and Air Conditioning, Construction Management, Architecture, Computer Information Systems, Building Inspection Technology, Commissioning, Energy Consulting/Auditing, Building Operations, Lighting, and Controls.

www.collegeofthedesert.edu/

Commscope Academy

Offers courses for installers, integrators, designers in a wide variety of trade topics including building automation. Link: https://www.commscopetraining.com/catalog/search/?q=smart+buildings

ETA-International

See Detailed Listing in Appendix E: Examples of Industry Education and Training

George Brown College

See Detailed Listing in Appendix E: Examples of Industry Education and Training

Georgia Piedmont Technical College

See Detailed Listing in Appendix E: Examples of Industry Education and Training

Heartland Community College

See Detailed Listing in Appendix E: Examples of Industry Education and Training

HeatSpring

Source for paid industry training. Offers courses accredited by AIA for CEU (Building Automation).

https://www.heatspring.com/app/courses?subject=Building%20Automation

ICEBO – International Conference on Enhanced Building Operation

Sponsored by Texas A&M University - (they have not been too active for a few years due to change in personnel but still some good content on their website)

https://icebo.tamu.edu/

InfoComm / AVIXA

See Detailed Listings in Appendix E: Examples of Industry Education and Training

Columbia College

Valencia College

Full Sail University

Benjamin Franklin Institute of Technology

City College of San Francisco

Sheffield Institute for the Recording Arts

ISA – International Society of Automation

ISA has a wide range of on-line and instructor led certificate based training courses. They are globally recognized for the Standards they develop including the latest for Building Controls Systems. They also have a Division specifically for Building Automation.

www.isa.org

Lambton College – Sustainable SmartHouse

The Sustainable SmartHouse is part of the Lambton Energy Research Centre (LERC) at Lambton College. It serves as an educational facility, testing laboratory and research facility that enables investigation of the intermittency issues associated with renewable energy systems, industrial and home automation, energy management and optimization, end-use hydrogen and fuel cells. It is open to anyone in the industry interested in technology development in sustainable energy; students, facility and the public.

https://www.lambtoncollege.ca/About_Us/Centres/Energy_Research_Centre/Home/

Lane Community College

Offers an Energy Management Program and uses its Downtown Campus building and systems to teach building automation, HVACR, and energy efficiency.

https://www.youtube.com/watch?v=Q6WofI-OGy0&t=62s

Laney College – Building Automation Systems (BAS)

See Detailed Listing in Appendix E: Examples of Industry Education and Training

Lincoln Technical Institute

See Detailed Listing in Appendix E: Examples of Industry Education and Training

LonMark Building Automation Program

See Detailed Listing in Appendix E: Examples of Industry Education and Training

LonMark Free Educational Seminars

Over 100 presentations with PDF and MP3 recordings from 10 years of industry events. Topics include: Building Automation, Smart Cities, Outdoor Lighting, Quick Serve Restaurants, Hospital/Health Care, Cyber Security, IoT, Control Networking, Case Studies, New Technology, and much more.

www.lonmark.org/connection/presentations/

Maverick Technical Institute

See Detailed Listing in Appendix E: Examples of Industry Education and Training

Milwaukee Technical Institute

See Detailed Listing in Appendix E: Examples of Industry Education and Training

Mt. San Antonio College

See Detailed Listing in Appendix E: Examples of Industry Education and Training

NATE – North American Technician Excellence

Offers training for technicians (electricians, mechanical, pipe fitters, sheet metal, energy, utility, etc.).

www.natex.org

NSF – National Science Foundation

The National Science Foundation (NSF) is a United States independent federal agency created by Congress in 1950 "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense..." With an annual budget of $7.5 billion (FY 2017), NSF is the funding source for approximately 24 percent of all federally supported basic research conducted by America's colleges and universities. In many fields such as mathematics, computer science and the social sciences, NSF is the major source of federal backing.

www.nsf.gov

O*NET – Occupational Information Network

Developed under the sponsorship of the U.S. Department of Labor/Employment and Training Administration (USDOL/ETA), the ONET database contains standardized and occupation-specific descriptors on almost 1,000 occupations covering the entire U.S. economy and is used to facilitate the development and maintenance of a skilled workforce.

www.onetonline.org/

Orange Technical College

See Detailed Listing in Appendix E: Examples of Industry Education and Training

ProMedia

See Detailed Listing in Appendix E: Examples of Industry Education and Training

RealComm

Jim Young's organization puts on several conferences a year. Don't know if they record/post but worth exploring. They focus on the commercial real estate leased space market. www.realcomm.com

Red Vector

Training for the workforce – Wide variety of industry training more for the process/manufacturing industry – not know specifically for their buildings training but worthy of mentioning. www.redvector.com

Seneca College – MBT Program

See Listing in Appendix E: Examples of Industry Education and Training

Smart Building Energy Summit

Sponsored by JLL, Jones Lange LaSalle, the Building Energy Summit® is an annual conference designed to educate building owners and operators on energy efficient technologies and solutions, collaborate on best practices, share successful case studies, and provide the resources needed to take action.

http://2017.buildingenergysummit.com/opalsingleevent-session/general-session/

Wharton County Junior College

See Detailed Listing in Appendix E: Examples of Industry Education and Training

APPENDIX E: EXAMPLES OF INDUSTRY EDUCATION AND TRAINING

1. AEE – Association of Energy Engineers: Atlanta, GA USA

WHO	Contractors who install these systems, building personal who operator these buildings and Trainers who can train this skill-set to both contractors and operators.
WHAT	Initially a Certificate with elevating the program training to include a National Certification and or credential. Example - "The Certified Energy Manager" CEM credential through the Association of Energy Engineers. Credentials offered include: Energy Manager in Training Certified Energy Manager Certified Sustainable Development Professional Certified Carbon and GHG Reduction Manager Certified Energy AuditorTM Certified Building Commissioning Professional Certified Business Energy Professional Certified Water Efficiency Professional Certified Energy Procurement Professional Certified Lighting Efficiency Professional Distributed Generation Certified Professional Certified Measurement and Verification professional Certified GeoExchange Designer Certified Power Quality Professional Certified Residential Energy Auditor Certified Renewable Energy Professional Existing Building Commissioning Professional Certified Building Energy Simulation Analyst Energy Efficiency Practitioner Certified Green Building Engineer
WHERE	There could be three delivery methods all covering the basic student outcomes and learning objective of the skill-sets necessary to cover and be proficient with Building Automation and that of a Knowledge-based Workforce for the Intelligent Building and Home Industries
WHEN	For this course content and that of the depth of the skills required, I would estimate that it would be an 8-12 weeks course minimum of 4-6 hours per session. There would need to be lab and relevant student experiential learning opportunities for those key topics needing hands on learning.
WHY	Benefits to the course learning objectives are that a segment of the built environment would be focused on and given attention regarding workforce training. A foundation for training will be created thus allowing for additional add-on learning as newer concepts, technologies and operational best practices are identified and documented for learning purposes. This effort will result in the improvement of Building Automation Systems while also increasing the on-going assurance of energy efficiency accuracy in systems. Lastly, the Building Automation Market is exploding. It is estimated and projected to be a 99-billion-dollar market by 2022.
For More Information	https://www.aeecenter.org/i4a/pages/index.cfm?pageID=4252; http://www.marketwatch.com/story/building-automation-system-market-worth-usd-9911-billion-by-2022-2017-03-09-10203319

2. Algonquin College: Nepean, ON Canada

WHO	Students registered in the *Electrical Engineering Technology Program during their third year can take as the elective course ELE8968 – Building Automation Systems (BAS).*
WHAT	*The three-year Electrical Engineering Technology program at Algonquin College prepares students to design and specify electrical equipment, systems and components. Technology students choose either an "automation" stream that emphasizes microelectronic control systems, or specialize in a "utilities" stream which focuses on elements of protection and control, and the design of transmission and distribution power systems.* *ELE8968- BAS course is a third-year elective course - part of the requirements for the Electrical Engineering Technology Program.* *EET credentials after completion (3 years) is: Ontario College Advanced Diploma*
WHERE	At the Algonquin College of Applied Arts and Technology, in the Electrical Engineering Technology program, one of the new courses being introduced in the automation stream is Building Automation Systems (BAS) *ELE8968 - BAS course is an elective course.*
WHEN	*The ELE8968 – BAS is a third-year elective course offered during the winter section (Jan. to April) in the EET program.*
WHY	BAS relates closely to the emerging field of the Intelligent Homes and Buildings. In this course, various topics related to BAS are covered, where students are introduced to the main components of BAS. Many technical aspects of automation including smart thermostats, Heating Ventilation and Air Conditioning (HVAC), lighting, access and security, measuring, sensing, actuation and digital controls are covered. The Internet of Things (IoT), Ambient Intelligence (AmI) concepts, real-world applications of wireless sensing/actuating devices and data acquisition systems (DAQ), as an important aspect of building automation, are introduced. In the lab, students design, build, test and troubleshoot various building automation components and subsystems. BAS course *is tailored for the students interested in pursuing their careers in "automation" i.e., building automation systems.*
For More Information	www.algonquincollege.com

3. APT College: Carlsbad, CA USA

WHO	Telecommunications and electric power industry
WHAT	Associate Degree in Telecommunications Technology Associate Degree in Information and Communications Technologies Associate Degree in Electric Power Systems Associate Degree in Renewable Energy Professional Certificate in Telecommunications Technology Professional Certificate in Telecommunications Essentials Professional Certificate in Wireless Essentials Professional Certificate in Fiber Optics Essentials and Advanced Applications Professional Certificate in IP Network Essentials Professional Certificate in Advanced IP Network Applications Professional Certificate in Electrical Fundamentals Professional Certificate in Transmission Fundamentals Professional Certificate in Transmission Operations Career Certificate in Renewable Energy
WHERE	The APT College curriculum is designed using a multimodal approach that includes online (asynchronous and webcast) as well as on ground classes. Our classes are available worldwide via the internet or local instructors available across the united states.
WHEN	APT College has rolling admissions and is available anytime.
WHY	APT has achieved several endorsements related to industry certifications that we offer within our programs to assure you of its commitment to dependable excellence in curriculum quality, instructional delivery and administration. Industry certifications provide students assurance that the courses meet industry standards in hands-on skills training and verify demonstrated learning outcomes.
For More Information	www.aptc.edu

4. Barry Career and Technical Education Center: Westbury, NY USA

WHO	High school students seeking immediate employment after graduation or a jump start on post-secondary technical training.
WHAT	Program covers copper and fiber infrastructure, telecommunications, and home technology integration. Students are offered the ESPA Certified EST certification exam.
WHERE	Joseph M. Barry Career and Technical Education Center (Barry Tech) is part of New York state's BOCES network of schools, is located in Westbury NY and serves central Long Island.
WHEN	Traditional school year calendar. Offered to high school juniors and seniors.
WHY	Students are prepared to go right to work in the electronic systems industry, including audio/video, cable, satellite, and security. They can also qualify for up to 11 credit hours at Queensboro Community College.
For More Information	http://www.nassauboces.org/Page/4498

5. British Columbia Institute of Technology: Burnaby, BC Canada

WHO	The program welcomes students with specified degrees, diplomas, red seal, BCIT's Sustainable Energy Management Advanced Certificate (SEMAC) program completion, or 20 years of related experience. Since the sector is quite diverse it is important to offer multiple entry options. The detailed entry requirements are provided here: http://www.bcit.ca/study/programs/5095adcert#entry
WHAT	The program is offered by: the British Columbia Institute of Technology, School of Construction and the Environment www.bcit.ca/bcem Advanced Certificate in Building Controls and Energy Management (BCEM). This program is designed as a part time studies program for those involved in all phases of a building's life: design, construction, commissioning, and ongoing operation. The aim of this program is to supply industry with graduates who can use controls and building automation systems to improve energy efficiency.
WHERE	British Columbia Institute of Technology – Burnaby, British Columbia, Canada. However, this a fully online program so it can be accessed anywhere in the world.
WHEN	The program has been running since September 2016 and accepts a cohort of students every September. The program is 1.5 years or 2.5 years long (student's choice) part time online. Student attend live online lectures every Tuesday night and the remainder of the material is covered on the student's own time following the assignment, quiz, and final project or exam deadlines.
WHY	The need for this program is driven by changes that are rapidly unfolding in the controls and building automation industry. Of particular importance is the effect that building controls and automation can have on the successful implementation of energy saving measures in buildings. Energy management cannot be successful without a strong understanding by all industry participants, from Facility Operators to Power Engineers to Commissioning Agents, of the way that controls can be optimized and used to improve energy management. Changes in technology are making building control systems more complex. Energy saving projects are becoming dependent on a strong user understanding of controls and how these new highly automated buildings are developed for energy savings. Our primary industry partner for this program, BC Hydro, has identified energy management and controls education as fundamental to meeting their energy saving targets. The proposed credential will be important to industry stakeholders because the convergence of the energy management and controls industries that has been happening in the field has not yet been linked in training and education. Often, individuals may specialize in one field or the other but not both. This combined field is now growing as more high-performance buildings are being constructed. An additional driver is the advent of "connected" buildings, with data from formerly isolated systems being integrated and sent to the internet cloud for third party analysis and diagnostics. The management and use of such data is becoming an important element for multiple professionals and stakeholders to inform decision making in building management.
For More Information	www.bcit.ca/bcem

6. Canadian Institute for Energy Training (CIET) / International Institute for Energy Training (IIET): Toronto, ON CANADA

WHO we Train	Energy managers in the industrial, building and public services sectors; Project Engineers; Building Recommissioning service providers; Building operating staff; Engineering professionals; Building/Facilities Operators; ESCO and Utilities employees; Employees responsible for EE program evaluation and operation; Energy Auditors: Energy performance contracting professionals; New and seasoned professionals alike from the industrial, commercial and the public sectors.
WHAT we Train	We offer Certification programs: Advanced Course on Building Recommissioning; Building Operator Certification; Certified Building Commissioning Professional; Certified Energy Auditor; Certified Energy Manager; Certified Measurement and Verification Professional; Certified Professional in Energy Performance Contracting; Certified RETScreen Expert. We also offer a variety of short thematic training on subjects related to energy and building management, as well as e-learning around issues related to regulations and climate change.
WHERE	Offered Across Canada by CIET, and available internationally through the IIET. We have trained over 7,000 professionals
WHEN	Our courses are offered in a variety of formats, including: 1) Public training courses, as advertised in our Fall and Winter calendars; 2) On-Site training, offered at our client's office or facility; 3) Customized education, according to client needs and delivery model; 4) E-Learning, either self-directed modules on via live webinars.
WHY	The Institute specialises in high quality energy management and energy efficiency training, as well as certification programs. Energy efficiency is by far the fastest, easiest and most logical way to fight climate change. CIET is therefore proud to have been a leader in this field for 20 years and counting.
For More Information	www.cietcanada.com

7. Central Nine Career Center Adult Education: Greenwood, IN USA

WHO	Career changers, especially those who have been identified by a government unemployment/retraining agency for specialized training and placement into a new career.
WHAT	Adult education offering, offered two nights a week for 10 weeks, allowing participants to work during the day while training. Curriculum directly supports the ESPA Certified EST credential.
WHERE	Central Nine Career Center, Greenwood IN. This program is part of their adult education department.
WHEN	Launched March 2017 and lasts 10 weeks.
WHY	Provides an opportunity to learn the basics, earn an industry certification, and get into a new career quickly. The school, government agency, and trade associations all help to ensure their employment after completion of the program.
For More Information	http://central9.k12.in.us/

8. College of DuPage: Glen Ellyn, IL USA

WHO	The program is targeted to those interested in Building Automation Systems and Energy Management Systems in the greater Chicagoland area.
WHAT	The Credential earned will be a *Building Automation Systems (BAS) Certificate*. The certificate will include at least two types of controllers that will be integrated together and used on real world equipment. The students will learn how a miniaturized central plant can be controlled with BAS equipment. There are two different platforms of programming, along with a look into how BAS equipment can be used for energy management in buildings.
WHERE	The classes are offered during the fall and spring semesters at The College of DuPage.
WHEN	The program starts Fall 2017 and can be finished in about a year. This certificate requires 37 credits in the courses.
WHY	The *Building Automation Systems (BAS) Certificate* prepares a student for entry level building automation and energy controls technician careers. The program is also offered to existing professionals who wish to develop into high performance building technicians.
For More Information	http://cod.edu/programs/hvacr/ https://www.youtube.com/watch?v=YKkB1AvpVqg&t=212s

9. College of the Desert: Palm Desert, CA USA

WHO	Students interested in the advanced energy, construction, utilities sector. Adults and Incumbent workers wanting to upskill to current (CA) Title 24 energy efficiency standards or Zero Net Energy practices.
WHAT	The Building and Energy Systems Professional, Associate of Science Degree offers students a broad overview into the energy efficiency, green technology, and building science industry and includes cross disciplinary courses in Energy Conservation Methods, Renewable Energy (generation and storage), Energy Systems, Heating Ventilation and Air Conditioning, Construction Management, Architecture, Computer Information Systems, Building Inspection Technology, Commissioning, Energy Consulting/Auditing, Building Operations, Lighting, and Controls. The completion of the Building and Energy Systems Professional, AS degree, is especially advantageous for the student in pursuit of an advanced energy industry leadership position. Electives are selected to support a concentration on industry specialties that are in high demand and stackable with other credentials and certificates. Students will have the option to focus on particular advanced energy sectors by choosing from various depths of study, such as, Alternative Energy Systems, Building Control and Environmental Systems, Advanced Lighting Systems, Building Analysis, Construction, and Inspection within the Zero Net Energy (ZNE) related fields. The student may choose their electives based on their immediate educational needs and goals. The student may also continue completing additional elective courses, combining other defined certificates (specialties) within the BESP Degree program. Upon completion students will have the technical background necessary to achieve multiple industry recognized credentials and careers.
WHERE	The program is currently offered at College of the Desert for 10 out of 15 of the individual certificates; it will be offered as the BESP Associate of Science degree program in the Spring of 2018.
WHEN	There are four entry points per year in the Spring, Summer, Fall, and Winter sessions. The classes are 8-weeks long with students taking two complimentary courses in each half of the 16-week semester, except summer and winter when only two entry level courses are available.
WHY	The goal for the Building and Energy Systems Professional, Associate of Science Degree (BESP) is to provide the student with the entry level skills, knowledge, and industry driven competencies to successfully enter and succeed in the Building Science and Advanced Energy Systems fields. The competencies are met through industry recognized (valued) credentials (IRC's) specifically related to each specialty (see Appendix B). The BESP specialties and their related IRC's are: Alternative Energy Technician/NABCEP, CSPV-I, CPVT-S Building Operator/BPI, NCI Green HVACR Commercial Technician/NATE, HVAC Excellence, EPA 608, BPI, NCI Green HVAC Residential Technician/NATE, HVAC Excellence, EPA 608, BPI, NCI Control Systems Specialist/NCI, GBA Advanced Lighting Technician/CALCTP-AT Building Energy Consultant/CEA, HERS, BPI, CABEC Construction Manager/CSLB, LEED-AP Building Inspector/PBI, ASHI Commissioning Technician/ACG, BPI, CABEC, CxT Zero Net Energy Technician/LEED-GA, NCI, BPI

	Power Generation and Distribution/NECA/IBEW Applied Construction Technology/CSLB Water Technology/SCATA Welding Technology/AWS \ Incumbent Workers (Skills Builders) The TAACCCT funded BESP program includes non-credit offerings for all students including incumbent workers at no tuition cost. These courses are designed to help workers elevate their skills and gain knowledge about ZNE and energy efficiency practices and methods. Non-Credit Certificates (in Progress) 1. Solar Photovoltaic 2. Energy Storage 3. Welding 4. Air Conditioning 5. Commercial Qlty. Maint. (Standard 180) 6. Energy Systems Technology 7. Industrial Calculations 8. Employability Skills 9. Residential Heat Pumps Certificate 10. Building Automation Controls Certificate 11. Commercial Gas Heating Certificate 12. Residential Gas & Heating Certificate 13. Residential HVACR Certificate 14. Commercial HVACR Certificate 15. Building Inspection Tech Certificate 16. Applied Construction Tech Certificate
For More Information	www.COD2Careers.com collegeofthedesert.edu

10. ETA – International: Greencastle, IN USA

WHO	Students, Military, Entry level technology personal, Trainers, Experienced Professionals and those involved in a degreed program leading to certification
WHAT	Certification programs used by schools to validate training and provide an industry credential include these areas*: Certified Electronics Technician Associate, Residential Electronics Systems Integrator, Audio/Video, Fiber Optics, Commercial Audio, Distributed Antenna Systems, Communications, Alarm and Security Systems, CCTV* and *Renewable Energy*
WHERE	Offered at any of the over 1,000 schools approved to provide ETA certification
WHEN	Depending on the program and the training group, the content provided may result in ETA certification testing. This can range from a short, entry-level training in fiber optics installation, leading to a certification credential and being employable, to a two or four-year University degreed program.
WHY	Working with various industry organizations such as Automation Federation both industrial and residential certification is provided to those who complete training with the over 1,000 schools and training groups who currently work with ETA. This is in the form of competencies at various industry skills and knowledge levels of certification attainment. Certification is often required as a prerequisite for hiring or contract negotiations.
For More Information	www.eta-i.org

11. George Brown College: Toronto, ON Canada

WHO	Students wishing to continue their education at the post-secondary education level. Graduates* with diploma/degrees from colleges/universities that want to specialize in Building Automation. *Students may qualify for advanced standing and graduate in 1 year.
WHAT	Electromechanical Engineering Technology – Building Automation Program (T171) Specialization in building automation is an emerging and growing employment opportunity, especially in the construction and property development sector. This advanced diploma program will provide the skills and knowledge in areas such as building science, building automation systems, networking and system integration.
WHERE	George Brown College, Casa Loma Campus, Toronto, Ontario
WHEN	3-Year, 6 Semesters, Post-Secondary program Semester 1 registration begins: September 2017 and January 2018
WHY	Builders and property managers require people to design and integrate technologies such as lighting, communications, security, Programmable Logic Controllers (PLC), Heating Ventilation and Air-Conditioning (HVAC), air quality monitoring, energy consumption and fire and safety equipment. They need technologists familiar with a centralized approach who can manage and control a building from an interface that provides building-wide efficiency, cost-effective operations and information sharing. Graduates from this program have been hired by companies like Siemens, Cisco, Mircom Group, Oxford Properties, Angus Property Management, Reliable Controls SPA, Modern Niagara and others.
For More Information	Electromechanical Engineering Technology – Building Automation Program (T171) http://www.georgebrown.ca/T171-2015-2016/

12. Georgia Piedmont Technical College: Clarkston, GA USA

WHO	High school and traditional college students; existing building, HVAC, or controls technicians; veterans and career changers.
WHAT	Building Automation Systems (BAS) is a two-year community college program offering: 1) Diploma or 2) Associate of Science Degree options. The diploma includes 50 units of classes while the degree option also requires completion of general education classes for a total of 67 units. All of the Building Automation specific classes are hybrid (online and in-person).
WHERE	The program is offered in Clarkston, GA at the main GPTC campus.
WHEN	Offered annually on a rolling admissions basis (we take new cohort groups twice a year), the program is designed to be completed in four semesters (two years) by a full-time student.
WHY	GPTC's BAS program was one of the first to be established at a community college in the U.S. The Air Conditioning Technology and Commercial Refrigeration programs complement the BAS program, which has implemented Living Lab pedagogy so students learn by working on an actual campus building. Siemens, Triatek, Emory University, McKinney's, United Maintenance, and Jones Lang LaSalle are some of the local employers who benefit from hiring BAS graduates.
For More Information	http://www.gptc.edu/content.cfm?PageCode=programgroup&ProgramGroupID=37 https://www.youtube.com/watch?v=0qioOL4onLk

13. Heartland Community College: Normal, IL USA

WHO	Traditional and Non-Traditional Students.
WHAT	Industrial Technology Certificate 30 credit hours and Renewable Energy Skills Certificate 19 credit hours
WHERE	Heartland Community College –1500 W. Raab Rd. Normal, Illinois 61761 Traditional Classroom
WHEN	Program starts fall term.
WHY	These certificates are part of a stacked certificate program with emphasis on fundamentals for entry level job opportunities in automation, building and industrial settings. This program has the opportunity for an internship in the field.
For More Information	http://www.heartland.edu/catalog/industrial

14. InfoComm/AVIXA – Benjamin Franklin Institute of Technology: Boston, MA USA

WHO	Students of secondary education; adult learners
WHAT	*Associate Degree in Computer Technology with concentration in AV Technology* – students will learn ins and outs of AV technologies, installation, networked systems, and system design processes and documentation.
WHERE	Benjamin Franklin Institute of Technology, Boston, MA
WHEN	66 credit hours full-time – 4 semesters
WHY	Program provides students with knowledge and training for a range of positions in information technology, based on the specific course selections of the student. Students have their choice of different concentrations of courses from modern areas of computer technology. Graduates of the various options may be qualified, respectively, for entry-level positions in system administration, computer programming, web development or database management, as well as positions as computer support specialists, and network or PC repair technicians. Graduates are also well prepared to continue their education in four-year BS programs in networking, computer science or system administration.
For More Information	http://www.bfit.edu/our-programs/computer-technology/av-technology/av-technology

15. InfoComm/AVIXA – City College of San Francisco: San Francisco, CA USA

WHO	Students of secondary education; adult learners
WHAT	AV Technician Certificate program - City College of San Francisco, Laney College, and Diablo Valley College are collaborating to offer a regional pathway to InfoComm/AVIXA's *Certified Technology Specialist certificate*, an audiovisual professional credential. The Audiovisual Technologist Certificate Program will prepare students for the Certified Technology Specialist (CTS®) exam and entry-level jobs in the audiovisual industry.
WHERE	City College of San Francisco, San Francisco, CA + Laney College, Peralta, CA -
WHEN	2018
WHY	Students will be able to analyze and apply the science and technology of basic audio and video equipment installations, and audiovisual systems integration. Graduates will gain skills in set up, testing, and troubleshooting audio systems, video systems, and AV technologies on a network. This Regional Certificate is offered by Laney College in Oakland's Peralta CCD and City College of San Francisco. Some courses are offered at City College and some at Laney and others have choices that can be taken at either college.
For More Information	https://www.ccsf.edu/

16. InfoComm/AVIXA – Columbia College: Chicago, IL USA

WHO	Students of secondary education; adult learners
WHAT	Course teaching fundamentals of audiovisual design and integration – as part of BA, BS degree
WHERE	Columbia College Chicago – Audio Arts and Acoustics program
WHEN	Fall – Spring - year calendar – 120 credit hours (8 semesters); Full-time status at Columbia College Chicago is 12 through 16 credits per semester
WHY	Specialize in live and recorded sound design, engineering and production/post-production; environmental and architectural acoustics for public, commercial and residential spaces; and design and management of audiovisual installations. Choose courses which focus on the specific techniques, technologies and aesthetics of the music industry and/or of sound, and become familiar with both large-format recording studios and desktop environments. You'll also study the science and physiology of sound and hearing.
For More Information	http://www.colum.edu/

17. InfoComm/AVIXA – Full Sail University: Winter Park, FL USA

WHO	Students of secondary education; adult learners
WHAT	*Show Production – Bachelor of Science (B.S.)* - Program focuses on the various components that go into creating concerts, live shows and corporate presentations, from lighting to sound design, and how audiovisual technologies play a key role in great live experiences.
WHERE	Full Sail University, Winter Park, FL – Music and Recording department and online
WHEN	Accelerated degrees. 20 months. Contains seven one-credit Career Modules that are woven throughout the curriculum
WHY	The university's recording arts bachelor's degree program centers on live music production and audio postproduction. Through this partnership, both programs will now offer InfoComm/AVIXA's *Essentials of AV Technology* course, *Certified Technology Specialist™ (CTS®) Prep* course and exam, and *AV Technologist* exam. In addition, Full Sail students will have free access to attend InfoComm/AVIXA's North America show and can attend three workshops free while there.
For More Information	https://www.fullsail.edu/degrees/show-production-bachelor

18. InfoComm/AVIXA – Sheffield Institute for the Recording Arts: Phoenix, AZ USA

WHO	Students of secondary education; adult learners
WHAT	TechWorks - teaches students the foundational skills they need to find work as audiovisual technicians and AV installers.
WHERE	Sheffield Institute for the Recording Arts, Phoenix, MD
WHEN	Typical full-time class is four days a week, four hours per day, 16 hours per week for 27 to 30 weeks. Part-time is two days a week, four hours per day, eight hours per week for 50 to 53 weeks.
WHY	Graduates will be qualified to apply for entry-level employment in the fields of audiovisual systems integration and maintenance, among others.
For More Information	http://www.sheffieldav.com/education/courses/techworks

19. InfoComm/AVIXA – Valencia College: Orlando, FL USA

WHO	Students of secondary education; adult learners
WHAT	*Entertainment Design and Technology Associate of Science (A.S.), Sound and Music Technology Associate of Science*, and more: two-year program preparing students to go directly into a specialized career in the entertainment industry. Specializations available in Live Show Production and Production Design
WHERE	Valencia College, Orlando, FL – Arts and Entertainment
WHEN	64 credit hours: Full-time – 2 to 3 years; Part-time – 3 to 4 years
WHY	This program is one of only a handful in the country, and the only one in Central Florida that trains students to work in all facets of the entertainment industry. From designing and constructing scenery to rigging and operating lighting, and audiovisual equipment, you'll gain hands-on experience working on real Valencia productions. When you graduate, you'll have the skills you need to work independently or as part of a creative team to produce live shows for concerts, theater, theme parks and corporate events.
For More Information	http://catalog.valenciacollege.edu/degrees/associateinscience/artsentertainment/entertainmentdesigntechnology/

20. Laney College- Building Automation Systems (BAS): Oakland, CA USA

WHO	High school and traditional college students; existing building, HVAC or controls technicians; veterans and career changers.
WHAT	Building Automation Systems (BAS) is a two-year community college program offering: 1) Certificate or 2) Associate of Science Degree options. The certificate includes 48 units of classes while the degree option also requires completion of general education classes for a total of 66 units.
WHERE	The program is offered in Oakland, California at Laney College (part of the Peralta Community College District). Laney is the only local community college with a BAS program and controls lab in the nine-county San Francisco Bay region.
WHEN	Offered annually on a rolling admissions basis, the program is designed to be completed in four semesters (two years) by a full-time student.
WHY	Laney has a two-year Commercial HVAC certificate/degree program, and a number of courses are common to both BAS and HVAC programs. Thus, BAS graduates will also possess a solid foundation in HVAC. In fact, some HVAC students have stayed longer to take the additional BAS classes in order to earn a second degree. For many local employers (e.g. Siemens, Honeywell), this is a very desirable combination of knowledge and skills because it reduces the amount of on-the-job training, and graduates find themselves quickly hired as entry-level technicians.
For More Information	http://www.laney.edu/ect http://www.laney.edu/wp/environmental_control_tech/ect-building-automation/

21. Lincoln Technical Institute: Union, NJ USA

WHO	High school grads, career changers, and veterans who want to become Electronic Systems Technicians (entry-level and above)
WHAT	11-month comprehensive training which includes extensive hands-on activities. Introduces students to a variety of subsystems, all from the technician's perspective. Some locations also offer an associate's degree option which covers management fundamentals. All Students earn NCCER certificate and have the opportunity to sit for the ESPA Certified EST certification.
WHERE	Lincoln Institute of Technology (Lincoln Tech) offers their EST program in six locations: Chicago IL, Indianapolis IN, Atlanta GA, Columbia MO, Union NJ, and Mahwah NJ. Some locations offer night classes.
WHEN	Classes have staggered starts, so no formal semester structure, and there are people graduating all times of the year.
WHY	This program is very comprehensive and focused on the EST as one of the trades on the jobsite. It covers a wide variety of systems so graduates are prepared to work in a number of verticals, as well as advance rapidly or move to another discipline.
For More Information	http://www.lincolntech.edu/careers/skilled-trades/electrical

22. LonMark Building Automation Program: Santa Clara, CA USA

WHO	Integrators, designers, operations personnel, maintenance personnel, property owners, property developers
WHAT	Building Automation Course includes modules: *Introduction to Smart Buildings* *Smart Building System Design and System Integration* *Fundamentals of Building Open Control Networking Systems* *Specifying Building Automation Systems* *Introduction to Designing Building Automation Dashboards, User Interfaces, and Public Kiosks* *Smart Buildings and the Smart Grid* *Introduction to LonWorks* Credentials available include: *LonMark Building Automation Course Certificate of Completion* *LonMark Refresher Course Certificate of Completion* *LonMark Certified Professional Credential* (after passing the Exam)
WHERE	All courses are available online, anytime, from anywhere
WHEN	Self-paced, online modules 20-30 hours for all modules of the *LonMark Building Automation Course* 6 hours for the *LonMark Refresher Course* 2-hours allowed for the *LonMark Certified Professional Exam*
WHY	Accomplishment of *LonMark Building Automation Course* provides *Certificate of Completion* Accomplishment of *LonMark Refresher Course* provides *Certificate of Completion* Pass the *LonMark Certified Professional Exam* to earn the Credential Earn Continuing Education Units, CEUs, for the American Institute of Architects, AIA Excellent credential for a Resume *NOTE:* This program/credential may be a specified requirement to bid on construction project
For More Information	www.lonmark.org/training https://test.lonmark.org *Portions of the program are also available through partners:* https://www.commscopetraining.com/catalog/search/?q=smart+buildings https://www.heatspring.com/app/courses?subject=Building%20Automation

23. Maverick Technical Institute: Nashua, NH USA

WHO	Target audience is high school grads who wish to go into the electronic systems industry with a broad understanding of the technologies and subsystems, and do not want to pursue a typical 2 or 4-year degree.
WHAT	10-month program focused on the fundamentals and real-world skills needed to be valuable on the job from day one. Topics include basic electronics, subsystems, networking fundamentals, programming, equipment installation and jobsite professionalism. Credentials offered include ESPA and CEDIA certifications. CompTIA exams may be offered in future sessions
WHERE	MTI is located in Nashua NH, and serves southern NH and the Boston area.
WHEN	Launched in 2016, this program is offered in approximately the format of a school year, starting in the fall and completing in the spring. The next session will begin in September 2017.
WHY	This program was built specifically to meet the huge demand for technicians in the residential systems industry and is being taught by industry professionals who know exactly what skills will be needed on the job. The school is well-connected to the industry and students are highly likely to have positions waiting for them when they graduate.
For More Information	http://mti.school/

24. Milwaukee Area Technical College: Milwaukee, WI USA

WHO	High school and traditional college students; existing building, HVAC or controls technicians; veterans and career changers.
WHAT	Automated Building Systems (ABS) is a diploma program that takes two full-time semesters to complete. It targets training students to meet the level 1 technician training of control vendors. There are 11 courses totaling 25 credits. The students have the option of taking an internship course for 1 credit. Started in fall 2016, the program is building enrollment. The college is looking at adding certificates and eventually expanding to multiple diplomas or an associate's degree. Once enrollment is strong, more classes will be added to allow for specialization, expanded certificates and degrees.
WHERE	The program is offered at the MATC South Campus, **Center** for Energy Conservation and Advanced Manufacturing (ECAM) Center in Oak Creek, WI. It is possible that portions of classes could be online in the future but most classes are lab formats requiring hands on.
WHEN	Each fall the program starts, and courses are completed in sequence culminating with the diploma in the spring semester. Not all courses have prerequisites so that part timers can focus initially on courses that do and pick up those that don't over time. Courses are a mix of day and night classes with the intent being all classes will rotate into the evening at least once every two years. All classes at this point are only offered once a year. As enrollment builds, that will change.
WHY	The benefits upon completion (having only had one cohort complete the program) is that the students all obtained jobs in the field. This program already has several classes that are integrated with sheet metal apprenticeships and power engineering programs. It allows for a direct tie with a major control vendor, Johnson Controls (JCI). JCI is also conducting some of their courses at ECAM as well as having hired one of the first three graduates last spring. Potential local employers include JCI, Trane, Milwaukee Public Schools, contractors, operators and consultants.
For More Information	Program website: http://www.matc.edu/tas/diplomas/automated-building-systems.cfm

25. Mt. San Antonio College: Walnut, CA USA

WHO	High school and traditional college students; existing building, HVAC or controls technicians; veterans and career changers.
WHAT	Building Automation Systems (BAS) is a two-year community college program offering: 1) Certificate or 2) Associate of Science Degree options. The certificate includes 36.5 units of classes while the degree option also requires completion of general education classes for a total of 60 units.
WHERE	The program is offered at the Walnut, CA campus.
WHEN	The program is designed to be completed in 2-3 semesters by a full-time student. Most courses are offered only once per year.
WHY	Mt. SAC's BAS program originally started under a Dept. of Labor grant and was one of the first to be established at a community college in the U.S. The Air Conditioning and Refrigeration Technology program complements the BAS program. Local employers meet students at an annual Industry Night event, which helps to facilitate hiring.
For More Information	Program website - http://www.mtsac.edu/buildingautomation/

26. Orange Technical College: Orlando, FL USA

WHO	High school seniors and graduates who have already completed at least two semesters of computer technology and networking, and wish to apply these skills in the dynamic electronic systems, building automation industry.
WHAT	Single semester elective to be offered as an advanced enhancement to the current IT program, opening up a whole new array of career verticals. Students have already earned CompTIA A+ and Net+ certifications. In the semester, they will add ESPA and CEDIA certifications.
WHERE	Orange Technical College, Orlando FL is part of a five-location network of non-profit technical schools serving central Florida. Orlando will be the first location to offer the Electronic Systems Integration course.
WHEN	This new program is being built now and will be offered in 2018. It is a one semester program offered only to students who have already completed two semesters of IT.
WHY	IT has quickly become a critical element of all installed electronic systems, both commercial and residential. The combination of networking skills and the fundamentals of electronic systems (and the industry credentials) will make these students highly sought after upon graduation.
For More Information	https://www.orangetechcollege.net/Pages/default.aspx

27. ProMedia Training: Fort Lauderdale, FL USA

WHO	Career changers, high school grads, recently displaced workers, and veterans who want a fast track into an entry-level technician role within the electronic systems industry.
WHAT	This is a concentrated "fast-track" program which covers only the fundamentals needed to get right to work, and then learn and advance while on the job. The training and hands-on exercises directly support the ESPA certification, and no advanced topics.
WHERE	ProMedia Training has been offering ProTools audio production training in multiple markets for many years and will be launching this EST program in 2017 in three locations initially: Los Angeles, Atlanta, and Miami. The session is five full days long, taught by industry professionals, and includes all of the critical hands on cable termination and testing skills as well as prep for the exam.
WHEN	Scheduled to begin in Q2 of 2017.
WHY	For individuals who need to get to work quickly, without a long commitment to technical training, this provides an opportunity to learn the basics, earn an industry certification, and have both the school and trade associations working to get them into the workforce in an entry-level position.
For More Information	http://www.promediatraining.com/

28. Seneca College – MBT Program: North York, ON Canada

WHO	Students registered in the *Mechanical Engineering, Building Sciences Technology (MBT) Program* during their third year take a course BGI561 – *Intelligent and Integrated Buildings*
WHAT	The three-year Mechanical Engineering Technology, Building Sciences program at Seneca College is the only program of its kind that prepares students to work with engineers, architects, and building operating staff in delivering the highest standards of green building design and operation. The program features a specialized third year to the Building Systems Engineering Technician program, providing students with enhanced opportunities for an exciting Green Career with emphasis in energy solutions and Intelligent and Integrated Buildings. BGI561- Intelligent and Integrated Buildings course is a third-year course - part of the requirements for the Mechanical Engineering Technology, Building Sciences program. MBT credentials after completion (3 years) is: Ontario College Advanced Diploma
WHERE	At Seneca College, in the *Mechanical Engineering Technology, Building Sciences* program, one of the advanced courses being introduced in the Building Sciences stream is *Intelligent and Integrated Buildings BGI561 - course* is a required professional course.
WHEN	The BGI561 – Intelligent and Integrated Buildings BGI561 - course is offered during the fall section (September to December) in the MBT program.
WHY	This course contains an introduction to networking essentials including the OSI model, network architectures, IP addressing and Ethernet/WLAN networking technologies. It then introduces networking technologies specific to the operation of Intelligent and Integrated Buildings (IIB) such as ZigBee wireless networking, ECHELON and BACnet. The application of these networking technologies is explored in the lab by the configuration and operation of several wired/wireless networking devices in order to demonstrate how they integrate with IIB and the course is tailored for the students interested in pursuing their careers in "automation" i.e., building automation systems with emphasis in energy solutions and Intelligent and Integrated Buildings (including operations).
For More Information	http://www.senecacollege.ca/fulltime/MBT.html

29. Wharton County Junior College: Wharton, TX USA

WHO	Recommended for those individuals who have a desire to pursue a career in architectural residential design as an apprentice or trainee.
WHAT	ENGINEERING DESIGN PROGRAM - Architectural Design Level II Certificate and Associate of Applied Science Degree - Engineering Design DFTG 1417 Architectural Drafting – Residential Architectural drafting procedures, practices, terms, and symbols. Preparation of detailed working drawings for residential structures. Emphasis on light frame construction methods. ***Course utilizes Autodesk REVIT, which create residential plans in 3D.* This program provides students with learning experiences in computer-aided design, architectural (residential) design, and structural design. Certificate course of study may also be applied to Associate of Applied Science Degree in Engineering Design
WHERE	Wharton County Junior College, Wharton and Richmond, Texas campuses
WHEN	Post-secondary 16-week college credit course is offered both Fall and Spring semesters. Registration begins August 2017 and November 2018.
WHY	Specialized learning experiences include the implementation of computer - aided design software in various design disciplines. Instruction emphasizes the development of technical knowledge and drafting skills that are essential to the successful entrance in the job market as a design technician. Former students have been employed as pipe designers, architectural designers, tool designers, civil designers, structural detail designers, electrical designers, and job estimators. The Engineering Design program provides workplace experiences recommended by the U.S. Department of Labor Secretary's Commission on Achieving Necessary Skills (SCANS).
For More Information	www.wcjc.edu/programs

WHY PURSUE A CAREER IN ELECTRONIC SYSTEMS?
An Introduction to the Industry

Technology and the World We Live In

Take a look around at today's world, compared to just a decade ago. The iPhone was launched in 2007, and now mobile access to virtually any kind of information is something we all take for granted. The internet is ubiquitous. It has changed the way we communicate, get our entertainment, and share our lives with others.

The internet has given birth to the "Internet of Things" (IoT), which means eventually every device that plugs in or has batteries will be part of a huge ecosystem that shares information and control with the other devices. And we are all part of it.
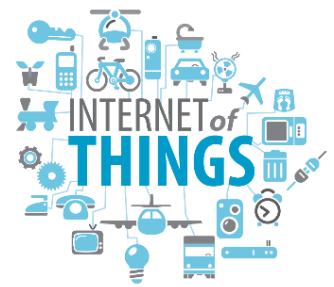
There is no end in sight for this technology take-over, no expiration date, no expectation that the growth will slow down. So, doesn't it make sense to be looking at careers that are tied directly to this technology?

It has been suggested that today's younger generation has a mindset which will motivate them to change jobs often, in their pursuit of new challenges and ways to really "make a difference". I can say from many years in the electronic systems industry that nobody I know has ever been bored. The new challenges come on an almost daily basis, as new ideas, technologies, and applications are introduced constantly. And very few things have as big an impact on a client than providing capabilities they never knew were possible, in a way that is easy for them to control and enjoy.

What Do We Mean by "Electronic Systems"?

Of course, the term "electronic systems" could be applied to many applications, from aerospace to manufacturing. But in general, when we use the term we are referring to low voltage devices and subsystems, installed in buildings, and integrated to be easily controlled as if they are all one larger system. A similar concept is found in an automobile: Dozens of sophisticated sub-systems are integrated together and presented to the drive in such a way that they are no longer really thought of as separate, but rather as one integrated machine. There are two main areas where these systems are found; in the home, and in businesses and public spaces.
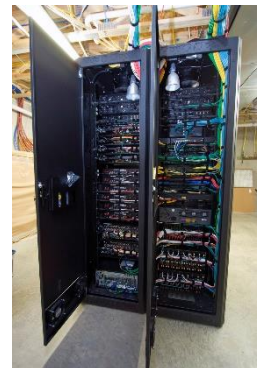
The actual technologies and components are mostly the same but are applied differently in each area of the industry. Systems common to both include the wiring infrastructure, audio and video distribution, security and surveillance, and access control. In the home, we find media rooms and home theaters, voice and mobile control, and some specialized functionality related to pools, driveways, shades, etc. In commercial applications we find digital signage, conference rooms, biometrics, video walls, large scale sound reinforcement, and other types of system monitoring, control, and automation.

In short, the electronic systems industry is all about using technology to providing solutions, sometimes extremely complex solutions, in a way that is stunningly easy for the end user to access and control.

What Are the Jobs? Where Are the Jobs?

Like in any industry, there are various types of workers doing different types of work. There are technicians, engineers, designers, project managers, programmers, sales people, and more. And the companies are not limited to any geographical area. This work is done everywhere in the country, in fact everywhere in the world. So, finding a job in a new location is not a problem.

The most important point, however, is that the demand for qualified people has never been higher. Virtually every employer in the industry is looking for people to add to their team, not only as entry-level technicians but in more advanced roles as well.

How Fast Can I Advance?

One of the most attractive things about working in this industry is how rapidly someone can make themselves more valuable and move into new positions with new responsibilities. In fact, a large percentage of people doing the more advanced work (engineering, design, programming) started as entry-level technicians and move up rapidly, by doing a good job and always seeking new knowledge and skills.

What Skills are Needed?

Every position requires a different skill set, but they all need to start with the fundamentals used by an entry-level EST (Electronic Systems Technician). Then these basics provide the foundation on which other knowledge is based. These areas of knowledge include: basic electricity, building methods and materials, tools (including documentation), cabling practices (including termination and testing of the most common cable types), and safety/codes/standards. Along with these basics, a comprehensive training path (school or self-study) should also include an introduction to audio, video, control systems, and several other subsystems which are commonly encountered in the field. Then the path to advancement includes on-the-job experience and additional training to be ready for the next career steps.

 An advanced EST fully understands the configuration and functionality of a system and is able to troubleshoot problems, supervise other technicians, and solve complex installation issues. A designer knows how to properly specify a system to meet the needs and budget of the client. An engineer can document precisely how everything is connected and configured. A programmer takes all of this information and sets up the control system to seamlessly control everything easily and dependably. All of the technical positions require an understanding of electronic equipment and computer networking. Project managers track all of the resources and labor over the life of the project to ensure success and profitability. Sales people work directly with the client to assess needs and ensure their satisfaction. In small companies, a few people may each wear more than one hat. In larger companies, there may be even more specific job descriptions. In all cases, EST fundamentals and a general understanding of subsystems are the required starting point. And a solid background in computer networking is a HUGE advantage, as all of these systems now depend on the network, or mobile devices, in one way or another.

Where Do I Start?

Due to the strong demand for technicians, and the increased outreach to schools by industry associations, more and more career centers and tech schools are incorporating the EST essentials and ESPA certification into existing electronics and computer courses. There are also a number of brand new programs being built and launched which cover not only the ESPA basics but the full introduction to electronic systems. These programs range from one semester to two years.

Another training model which is being launched is a "fast-track" type session, which involves 40-60 hours of instructional time, including the required hands-on activities to ensure that the new EST can perform basic tasks on the jobsite. These may be in a 5 day "basic training" format or delivered as night classes over several weeks. The outcome is similar: introduction to just the ESPA body of knowledge, some hands-on experience, and the opportunity to earn the EST certification…. followed by a well-coordinated effort to find employment for every successful participant. If there is no school or training program available in your area, it is possible to study the ESPA Training Guide, learn to terminate and test cables, and sit for the exam on your own, although this is the least ideal scenario. There are also self-paced online courses available to enhance the content in the book. In order to be more prepared for actual employment we also highly recommend the Fundamentals of Residential Electronic Systems book from CEDIA. With or without their ESC certification, this knowledge will be extremely valuable regardless of what sector of the industry you go to work in. It serves as an introduction to most of the technologies and subsystems you will be working with once in the industry.

Who is ESPA? What Does the Certification Tell Potential Employers?

Industry certifications send a clear message to employers. This is true in any field. It proves that the candidate:

- *has studied the content and mastered at least the key points*
- *takes training and learning seriously enough to make the effort to earn a credential*
- *wants to stand out among applicants as the one who has proven their knowledge*
- *will be more likely to continue to learn, grow, and earn higher credential once on the job*

In some areas of work, certain certifications are mandatory, but in electronic systems this is usually not the case, other than some areas which require a low-voltage license. However, the best companies are usually the ones who encourage and look closely at industry and manufacturer training and certification when they hire and promote people. The ESPA certification is intended to be the first step to get to work. After that it is expected that you will pursue higher certifications which are specific to the segment of the industry you have chosen.

Where Can I Learn More?

The ESPA website (www.espa.org) serves as a single point resource which helps you find more information in a number of places. Go to the TRAINING RESOURCES tab, and click through to links which take you to several associations, publications, online training, and job boards. Thoroughly exploring these links will give you a very broad introduction the industry, what systems integrators do, what today's technologies look like, and how you might fit in. If you have additional questions, ESPA is always eager to help. Just reach us at certification@espa.org.

ESPA FOUNDERS

ESPA INDUSTRY PARTNERS

www.espa.org   certification@espa.org   (317) 222-3250

ELECTRONIC SYSTEMS INDUSTRY WORKFORCE UPDATE
OCTOBER 2016

INTRODUCTION

The same rapid changes in technology that have impacted everyone's daily life over the past decade or two have also brought extraordinary change in the systems which deliver entertainment, functionality, energy efficiency, and security to buildings - from single family homes to skyscrapers, hotels, and multi-use venues. This has resulted in a huge demand for skilled personnel in a wide range of positions, in an industry most people are not even aware of. This document is intended to bring some clarity to what the industry does, how it is growing, and the demand for qualified workers.

DEFINITION OF TERMS

By definition, electronic systems could include just about anything that plugs in or has batteries. There are electronic systems in automobiles and aircraft, and even spacecraft. But in general, the term is applied to low voltage systems and subsystems installed in buildings. Not to be confused with the work done by electricians, this includes low-voltage technologies such as audio, video, control systems, security and surveillance, and

the infrastructure that supports these systems – copper, fiber optic, and wireless. Much of the same technology is applied to both residential and commercial projects, but used differently depending on the application. The companies who design and install these complex systems are essentially integrating several subsystems into one, so you will often see them referred to as systems integrators. The personnel who install, service, and upgrade these systems in the field are known as Electronic Systems Technicians (ESTs).

CAREERS

The career paths are diverse, and go well beyond the ESTs in the field. Like any technical industry, there are a variety of skillsets needed to make a project happen; from sales to designers, engineers, project managers, and programmers. All of these are specialized, but all rely on a similar fundamental body of knowledge. And many of these positions are filled by people who started out as entry-level technicians and advanced by learning and gaining experience within the industry.

INDUSTRY GROWTH

Although electronic systems are often retrofitted into existing structures or installed as part of a remodel/refurbish project, most of the growth is related to the growth in new construction. In the U.S. this has been rapid in the last few years. Housing starts are estimated to be 1.2 million in 2016, the highest since before the recession[7], and overall installed home technologies are annually around $20 billion.[8] This is due to a number of factors, including new entertainment technologies, the widespread use of mobile devices, and the concept of "aging in place" as baby boomers retire. Commercial new construction, and therefore the electronic systems, are seeing similar growth rates, and in fact was not hit as hard as residential during the recession, mostly due to the longer project cycles. Growth is especially strong in education and health care.

These trends are global, and the U.S. is leading the way, especially in residential systems, where "smart home" revenues are expected to triple by 2021[9]. We are also seeing a lot of crossover between various types of contractors, i.e.: residential integrators doing more light commercial, and security companies doing more audio, video, and control.

DEMAND FOR QUALIFIED WORKERS

In each of the last two years, both commercial and residential integrators reported that they expect their staffing to increase an average of 14% per year.[8,10] These additions are in all types of positions. During the recession, the biggest challenge faced by integrators was generating sales. Now in the last few years the challenge has been finding the people to do the work. Industry associations have turned their attention to helping member companies identify qualified candidates, and every major association we know of has started initiatives to raise awareness in the academic channel and promote programs which train people to work in the industry.
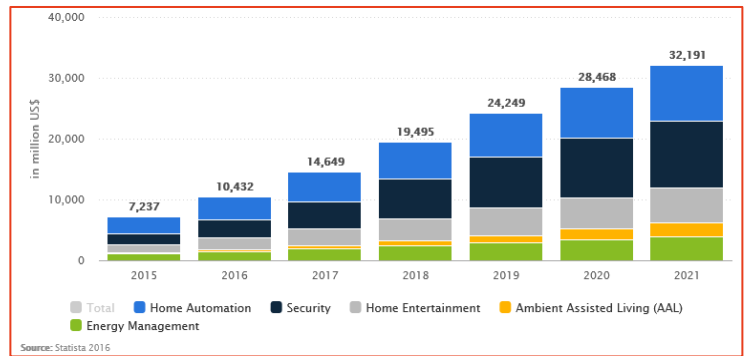
Due to the shortage of talent and increased workload, compensation has seen a solid upward trend.   Most commercial integrators will be awarding pay increases of 5-8% across the board this year, the highest increases reported since 2005.[10]   Residential integrators report even higher compensation increases, averaging 10% from 2013 to 2015.[8,11]   The average annual base compensation for an experienced EST (commercial and residential) is $44,000 to $48,000, and most are seeing a lot of overtime as well as incentive pay.[8,10]

Entry-level technicians start out lower but can advance very quickly. Engineers, designers, and programmers earn more, and many of them started their career as entry-level technicians.

NEXT STEPS

Most of the "hot" career paths for the 21st century are well known, such as health care and IT. But not so with the electronic systems industry. So, a concerted effort is being undertaken to make young people aware of the exciting and rewarding careers available. NSCA's Education Foundation has launched an initiative known as Ignite, to "spark interest in technology" among high schoolers. Other associations are also reaching out to various demographics, such as career changers and veterans, to let them know of the opportunities that are abundant in the industry.

The Continental Automated Building Association (CABA) is currently developing a white paper which will better define the skills and knowledge needed for various careers, and make recommendations to the academic channel on how to prepare people for these positions.
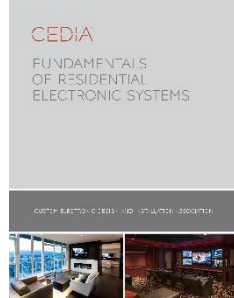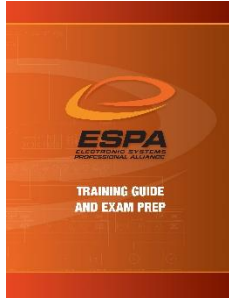
The Electronic Systems Professional Alliance (ESPA) offers training resources and an industry-recognized certification for entry-level ESTs regardless of which of the career verticals they pursue. This can be dropped into an existing electronics or IT program as an enhancement, offered as a free-standing "fast track", or used as the foundation of a more comprehensive electronic systems program which also includes a broad introduction to the technology and terminology of the industry. This should include all of the subsystems someone will need to understand when they go to work, regardless of what role they take on. CEDIA offers the Fundamentals of Residential Electronic Systems book, which complements the ESPA basics by introducing topics such as audio, video, control, security, and home theater. Some additional content should be included to cover disciplines unique to the commercial side, such as conference rooms and digital signage. The ideal outcome of a comprehensive program is for the student to be prepared to enter any sector of the electronic systems industry with a solid set of skills that will shorten their learning curve on the job and allow them to advance quickly. Holding certifications from ESPA and CEDIA will greatly assist them in gaining employment. In addition, since today's systems are so dependent on the network, training and certification in computers and networking (such as CompTIA A+ and Net+) makes a candidate even more attractive.

CONCLUSION

The electronic systems industry is growing rapidly and changing constantly. A career in this field offers great potential for advancement, and a work environment that will always be challenging as new technologies are introduced. The current demand for qualified employees is higher than ever, and a well-trained and certified individual is virtually assured of immediate employment. Every major market has at least 100 potential employers eager to identify qualified applicants.

The ESPA program was founded by three leading industry associations (NSCA, CEDIA and CTA) and is also recognized by ESA, CABA and CompTIA.

For more information, www.espa.org or certification@espa.org.

FAST FACTS
AUDIO AND VIDEO EQUIPMENT TECHNICIANS

INTERNATIONAL

70,415 TOTAL NUMBER OF FULL-TIME AND PART-TIME **AUDIO AND VIDEO TECHNICIAN JOBS** IN THE U.S. ECONOMY FROM 2016

2.4% **INCREASE** FROM 2015-2016

EARNINGS

MEDIAN EARNINGS
$20.13 /hr

25%
OF AUDIO AND VIDEO TECHNICIANS MAKE OVER
$26.94/hr

ONLINE JOB POSTINGS

6.5% **INCREASE** IN AVERAGE MONTHLY ONLINE JOB POSTINGS FROM 2015-2016

In 2016, there were **2,741 average monthly unique online job postings for Audio and Video Equipment Technicians.**

In 2015, there were **2,573 average monthly unique job postings for Audio and Video Equipment Technicians.**

That's a 6.5% increase in online job postings.

6,120

AUDIO AND VIDEO EQUIPMENT TECNICIANS HIRED PER MONTH

In an average month, from 2015-2016, there were 2,741 unique job postings for Audio and Video Equipment Technicians, and 6,120 actually hired.

This indicates that one job posting may be intended to fill multiple Audio and Video Technician job roles, or that Audio and Video Technicians are typically hired by channels other than online postings.

TOP INDUSTRIES EMPLOYING AUDIO AND VIDEO EQUIPMENT TECHNICIANS (2016)

MOTION PICTURE AND VIDEO PRODUCTION

11,172 Jobs in Industry **15.9%** Occupation in Industry

PROMOTERS OF PERFORMING ARTS, SPORTS, AND SIMILAR EVENTS WITH FACILITIES

6,631 Jobs in Industry **9.4%** Occupation in Industry

TELEVISION BROADCASTING

3,311 Jobs in Industry **4.7%** Occupation in Industry

TOP CITIES POSTING WITH JOB TITLE AUDIOVISUAL TECHNICIANS

NEW YORK, NY

LOS ANGELES, CA

WASHINGTON, DC

CHICAGO, IL

SAN FRANCISCO, CA

2016 REGIONAL BREAKDOWN (JOBS)

ILLINOIS **2,425 - 3%**
NEW YORK **6,963 - 10%**
CALIFORNIA **15,263 - 22%**
TEXAS **4,477 - 6%**
FLORIDA **4,217 - 6%**
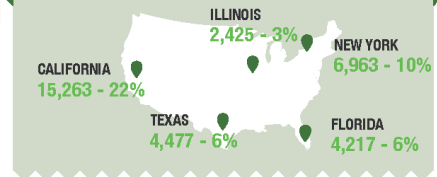
OCCUPATION AGE BREAKDOWN

+65 **2.8%**
55-64 **12.3%**
45-54 **20.6%**
35-44 **23.3%**
14-18 **1.2%**
19-24 **10.7%**
25-34 **29.1%**

TOP COMPANIES POSTING FOR AUDIO AND VIDEO EQUIPMENT TECHNICIANS

PSAV Presentation Services   Encore Event Technologies

AVMS
(Audio Visual Meeting Solutions)   J&S Audio Visual   Five-Star AudioVisual

SKILLS AND CERTIFICATIONS

TOP OCCUPATIONS
- Audio and Video Equipment Technicians
- AV and Multimedia Collections Specialists
- Producers and Directors
- Broadcast Technicians
- Sound Engineering Technicians

UNIQUE SKILLS
- Live Sound Mixing
- Lighting Producers and Directors
- Sound Reinforcement Systems
- Stage Lighting
- Audio Editing Software

TOP CERTIFICATIONS
- Certified Technology Specialist - Design
- Certified Technology Specialist - Installation
- Certified Technology Specialist
- Project Management Professional

Explore Something New in 2017

General Knowledge / Core Knowledge / Continuing Education / Resources

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Customize your training — or training for your whole organization — with one-on-one guidance, infocomm.org/customerservice.

The course textbook is offered in other languages.   † Offered in multiple formats.   ‡ Available upon request.

Installer

General Knowledge
- Quick Start to the AV Industry Online*
- Microcredentials
  - Pulling Cable
  - Terminating Cable
  - Mounting Equipment
- Essentials of AV Technology*†
- AV Technologist Test (AVT)*
- AV Math Online*
- Project Management for AV Online
- CTS® Prep*†
  - Register for CTS Exam

Core Knowledge
- Introduction to Installation Online*
- Elements of System Fabrication Online
- Elements of Setup and Verification Online
- Installation 1: System Fabrication*
- Installation 2: Setup and Verification
- How to Install and Validate Category Cable for AV
- Networking Technology*†
- CTS-I Prep†
  - Register for CTS Exam

Continuing Education
- Project Management for AV
- Networked AV Systems
- Harnessing the Cloud for the AV Pro
- Training at Trade Shows
- Webinars

Resources
- Books, Standards and Resources
  - CTS Exam Guide, Second Edition
  - Networked AV Systems
  - CTS-I Exam Guide
  - AV Setup Guide for Events, Meetings, Conferences, and Classrooms*
  - ANSI/INFOCOMM A102.01:2017, Audio Coverage Uniformity in Listener Areas
  - ANSI/INFOCOMM 2M-2010 Standard Guide for Audiovisual Systems Design and Coordination Processes
  - ANSI/INFOCOMM 3M-2011 Projector/Image System Contrast Ratio
  - ANSI/INFOCOMM 4:2012 Audiovisual Systems Energy Management
  - ANSI/INFOCOMM 10:2013 Audiovisual Systems Performance Verification
  - ANSI/INFOCOMM V202.01:2016 Display Image Size for 2D Content in Audiovisual Systems
  - Audiovisual Systems Performance Verification Guide
  - InfoComm Cable Labeling for Audiovisual Systems (CAD) Standard
  - Standard Quizzes

Designer

General Knowledge
- Quick Start to the AV Industry Online*
- Essentials of AV Technology*†
- AV Technologist Test (AVT)*
- AV Math Online*
- Project Management for AV Online
- CTS® Prep*†
  - Register for CTS Exam

Core Knowledge
- AV Math for Design Online
- AV Design 1: Environment*†
- AV Design 2: Infrastructure*†
- AV Design 3: Applied Design*†
- Networking Technology*†
- CTS-D Prep†
  - Register for CTS Exam

Continuing Education
- Networked AV Systems
- Harnessing the Cloud for the AV Pro
- Training at Trade Shows
- Webinars

Resources
- Books, Standards and Resources
  - CTS Exam Guide, Second Edition
  - Networked AV Systems
  - CTS-D Exam Guide
  - AV Implementation Handbook
  - AV/IT Infrastructure Guidelines for Owners
  - ANSI/INFOCOMM A102.01:2017, Audio Coverage Uniformity in Listener Areas
  - ANSI/INFOCOMM 2M-2010 Standard Guide for Audiovisual Systems Design and Coordination Processes
  - ANSI/INFOCOMM 3M-2011 Projector/Image System Contrast Ratio
  - ANSI/INFOCOMM 4:2012 Audiovisual Systems Energy Management
  - ANSI/INFOCOMM 10:2013 Audiovisual Systems Performance Verification
  - ANSI/INFOCOMM V202.01:2016 Display Image Size for 2D Content in Audiovisual Systems
  - Audiovisual Systems Performance Verification Guide
  - Audiovisual Systems Performance Verification Guide
  - CEA/CEDIA/INFOCOMM J-STD-710, Audio, Video and Control Architectural Drawing Symbols Standard*
  - Standard Quizzes

IT Professional

General Knowledge
- Quick Start to the AV Industry Online*
- Essentials of AV Technology*†
- AV Technologist Test (AVT)*
- Project Management for AV Online
- CTS® Prep†
  - Register for CTS Exam

Core Knowledge
- AV Design 1: Environment*†
- Networked AV Systems
- Harnessing the Cloud for the AV Pro

Continuing Education
- How to Effectively Manage AV Staff
- Training at Trade Shows
- Webinars

Resources
- Books, Standards and Resources
  - CTS Exam Guide, Second Edition
  - Networked AV Systems
  - AV Implementation Handbook
  - ANSI/INFOCOMM 4:2012 Audiovisual Systems Energy Management
  - The Role of AV in an Industry in Unified Communications and Collaboration
  - Standard Quizzes

Technology Manager

General Knowledge
- Quick Start to the AV Industry Online*
- Essentials of AV Technology*†
- AV Technologist Test (AVT)*
- AV Math Online*
- Project Management for AV Online
- CTS® Prep†
  - Register for CTS Exam

Core Knowledge
- AV Design 1: Environment*†
- Digital Signage for Technology Managers Online
- Harnessing the Cloud for the AV Pro
- Introduction to Installation Online*
- Networking Technology*†
- Event Setup for AV Techs Online*

Continuing Education
- How to Effectively Manage AV Staff
- Project Management for AV
- Networked AV Systems
- Training at Trade Shows
- Webinars

Resources
- Books, Standards and Resources
  - CTS Exam Guide, Second Edition
  - Networked AV Systems
  - AV Setup Guide for Events, Meetings, Conferences, and Classrooms*
  - AV Implementation Handbook
  - AV/IT Infrastructure Guidelines for Higher Education
  - The Role of AV in an Industry in Unified Communications and Collaboration
  - ANSI/INFOCOMM 2M-2010 Standard Guide for Audiovisual Systems Design and Coordination Processes
  - ANSI/INFOCOMM V202.01:2016 Display Image Size for 2D Content in Audiovisual Systems
  - ANSI/INFOCOMM 10:2013 Audiovisual Systems Performance Verification
  - Standard Quizzes

Project Manager

General Knowledge
- Quick Start to the AV Industry Online*
- Essentials of AV Technology*†
- AV Technologist Test (AVT)*
- AV Math Online*
- Project Management for AV Online
- CTS® Prep†
  - Register for CTS Exam

Core Knowledge
- AV Design 1: Environment*†
- Networking Technology*†
- Project Management for AV

Continuing Education
- Networked AV Systems
- Harnessing the Cloud for the AV Pro
- Training at Trade Shows
- Webinars

Resources
- Books, Standards and Resources
  - CTS Exam Guide, Second Edition
  - Networked AV Systems
  - AV Implementation Handbook
  - ANSI/INFOCOMM A102.01:2017, Audio Coverage Uniformity in Listener Areas
  - ANSI/INFOCOMM 2M-2010 Standard Guide for Audiovisual Systems Design and Coordination Processes
  - ANSI/INFOCOMM 3M-2011 Projector/Image System Contrast Ratio
  - ANSI/INFOCOMM V202.01:2016 Display Image Size for 2D Content in Audiovisual Systems
  - ANSI/INFOCOMM 10:2013 Audiovisual Systems Performance Verification
  - Audiovisual Systems Energy Management 901 Calculator
  - Standard Quizzes

Business Development Manager

General Knowledge
- Quick Start to the AV Industry Online*
- Essentials of AV Technology*†
- AV Technologist Test (AVT)*
- AV Math Online*
- Project Management for AV Online
- CTS® Prep†
  - Register for CTS Exam

Core Knowledge
- AV Design 1: Environment*†
- Networking Technology*†
- Project Management for AV

Continuing Education
- Networked AV Systems
- Harnessing the Cloud for the AV Pro
- Training at Trade Shows
- Webinars

Resources
- Books, Standards and Resources
  - CTS Exam Guide, Second Edition
  - Networked AV Systems
  - ANSI/INFOCOMM 2M-2010 Standard Guide for Audiovisual Systems Design and Coordination Processes
  - ANSI/INFOCOMM 10:2013 Audiovisual Systems Performance Verification
  - Standard Quizzes

Live Events Professional

General Knowledge
- Quick Start to the AV Industry Online*
- Essentials of AV Technology*†
- AV Technologist Test (AVT)*
- AV Math Online*
- Project Management for AV Online
- CTS® Prep†
  - Register for CTS Exam

Core Knowledge
- Event Setup for AV Techs Online*
- Networking Technology*†
- Project Management for Live Events

Continuing Education
- Harnessing the Cloud for the AV Pro
- Training at Trade Shows
- Webinars

Resources
- Books, Standards and Resources
  - CTS Exam Guide, Second Edition
  - AV Setup Guide for Events, Meetings, Conferences, and Classrooms*
  - ANSI/INFOCOMM A102.01:2017, Audio Coverage Uniformity in Listener Areas
  - ANSI/INFOCOMM 3M-2011 Projector/Image System Contrast Ratio
  - ANSI/INFOCOMM 4:2012 Audiovisual Systems Energy Management
  - ANSI/INFOCOMM V202.01:2016 Display Image Size for 2D Content in Audiovisual Systems
  - Standard Quizzes

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7. **Custom Electronic Design & Installation Association (CEDIA):** *Benchmarking Survey 2013*

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