

Memo

To: **EEAC**
From: **EEAC Consultant Team**
Date: **December 30, 2015**
Subject: **C&I Innovation – A Review of Training and Educational Offerings**

INTRODUCTION

The Massachusetts Program Administrators (PAs) support a wide range of training opportunities throughout the state. Training and education is an important step in market transformation since it enables market actors such as architects, building operators, engineers, contractors, and program implementers to promote the latest energy efficiency information, methods, and practices. In addition, training helps to engage the market actors with the PAs and their programs. The purpose of this memo is to educate the Council as to the state of currently offered commercial and industrial (C&I) trainings, how they are promoted and opportunities for new training programs.

As a starting point for this review, we identified what training opportunities are being offered by the PAs and advertised through the MassSave® website, with the assumption that this would be the first place target market actors would look. We also identified PA sponsored opportunities being offered through other organizations or groups including the Massachusetts Energy Efficiency Partnership (MAEEP), GasNetworks, and local chapters of trade organizations. The Green Jobs Academy (GJA) also offers training independently of the PAs. We then compiled the offerings and organized them into three primary categories: energy codes, energy efficient technology, and technical services and skills. For each category, we reviewed the content, frequency, and location of the offerings to identify where coverage gaps may exist. To the extent that gaps do exist, we offer recommendations for addressing them.

The Consultants also recognize that the PAs provide a large number of trainings both on the energy efficiency programs and on technical topics through associations and trade groups such as ASHRAE.¹ The 2016-2018 Energy Efficiency Plan lists the range of trainings offered in the past three years, which served 3,200 people.² Because these training opportunities are limited to the trade group members, and are not open or advertised to the general public, it is difficult to know if there are gaps between these trainings and publically offered trainings. However, it is reasonable to assume that many market actors would be affiliated with a professional group, and therefore may have access to appropriate training opportunities through their trade or professional association.

CURRENT OFFERINGS AND GAPS IN COVERAGE

Technical Services and Skills

There are several avenues that market actors can explore for education opportunities for technical services and/or skills related to energy efficiency in the C&I sector. We identified opportunities through the MAEEP,

¹ <http://ma-eeac.org/wordpress/wp-content/uploads/Exhibit-1-Gas-and-Electric-PAs-Plan-2016-2018-with-App-except-App-U.pdf> page 157

² Ibid. page 159

GasNetworks, Building Operator Certification (BOC), MassSave®, and the Green Jobs Academy (GJA) websites.

MASSACHUSETTS ENERGY EFFICIENCY PARTNERSHIP

Over the past few years the MAEEP has held training and educational opportunities for a variety of technical skills. These opportunities, which are typically held at the Four Points by Sheraton hotel in Norwood, are full day training sessions and cost \$150 per registrant. In 2015, MAEEP held trainings on HVAC systems, compressed air systems, energy modeling, net-zero energy through retro-commissioning, commissioning, and steam system assessments (see Table 4). In years past, the MAEEP held a training on existing building retro-commissioning in addition to an earlier version of the energy efficiency using eQUEST training that was held in 2015.

We found that there is a good variety of content being covered for technical skills, but that the opportunities are infrequent considering the potential high-impact of these skills. For example, trainings on DOE tools such as the Chilled Water System Analysis Tool, the CHP Application Tool, and the Pumping System Assessment Tool have been offered in the past, but not in 2015.³ These tools are helpful to identify savings and being certified as a qualified user demonstrates an advanced level of expertise and competency by auditors and engineers.

Table 1 | Technical Services and Skills Training Offered Through MAEEP, 2015

Topic	Topics Discussed	Date
HVAC Technology Enhancements for Energy Conservation	Steps recommended to improve HVAC energy efficiency in an existing building; Identifying areas of energy improvement; HVAC interaction with other building systems as it relates to energy use; Monitoring tools for evaluating energy usage.	1/21/2015
Fundamentals of Compressed Air Systems	Evaluating systems and applying proven techniques; Calculate and reduce system operating costs; Diagnose and address production and pressure control problems; Improve equipment specification and system; Maintain and improve system efficiency.	2/26/2015 6/4/2015
Energy Efficiency Using eQUEST	eQUEST is currently the most popular energy modeling program in use. Its popularity derives from a combination of graphic user interface that includes a wizard to assist in the model creation, a powerful DOE2 calculation engine, and its availability at no cost. The program makes it so simple to create a building model that there is always a potential for garbage in, garbage out problem, especially for first time users. This course will offer insight into the workings of the eQUEST program as well as guidance in using the program and checking results to give the inexperienced user some confidence that the energy model is working as intended.	3/19/2015
The Path to Net-Zero Energy through Retro-Commissioning	Participants will learn about the various standards that exist in the built environment around a net-zero energy future. Retro-commissioning will be reviewed with a focus toward reducing current energy use and strategies to take one along the path to net-zero energy. Participants will learn what other building owners are doing to create net-zero energy buildings and what strategies might be explored to get the existing building to net-zero through comprehensive re-engineering and retrofit.	6/25/2015
Steam System Assessment Training	This training covers the operation of typical steam systems and discusses methods of system efficiency improvement. The training is designed for end users – at the energy manager, steam system supervisor, engineer, and operations level – who have steam system responsibilities in industrial and institutional plants.	10/7/2015
Monitoring Based Commissioning (MBCx)	This course will introduce MBCx, discuss how it fits into an overall Energy Plan, describe the advantages over other types of commissioning, review the requirements of a successful MBCx program, demonstrate typical findings of MBCx, and inform participants of some of the challenges of setting up MBCx programs. There will be a discussion of utility incentive programs related to MBCx, and a review of customer experiences.	11/12/2015

³ <https://www.maeep.org/doetools>

GASNETWORKS

Through GasNetworks, Emerson Swan, a manufacturer's representative organization that also provides training services, offered two types of training opportunities in 2015 for skills that contractors and engineers might find useful for designing and selling hydronic systems. These services are half- to full-day courses that cost \$25 to \$40, respectively (see Table 5).⁴

Table 2 | Technical Services and Skills Training Offered Through GasNetworks, 2015

Topic	Description	Dates
Selling Hydronics	This seminar is intended for contractors who wish to gain a better understanding of the sales process and how to apply it to their business	5/14/2015 9/22/2015 10/1/2015
Taco FloPro Designer	This seminar explores Taco's FloPro Hydronic System Designer software which is used to calculate system heat loss and gain and assists in the design of hydronic systems.	4/7/2015 10/13/2015

BUILDING OPERATOR CERTIFICATE PROGRAM

Through the BOC program, students learn about a variety of skills associated with achieving electricity and fossil fuel savings in the buildings they manage. The certification, which has produced positive documented energy savings since 2000, includes, but is not limited to, courses on efficient operation of HVAC systems, measuring and benchmarking energy performance, efficient lighting, and HVAC controls. In 2015, the BOC program offered a Level 1 BOC course in Worcester which was completed by 24 registrants. The BOC program also offered a Level 1 BOC course that was hosted by the Division of Capital Asset Management and Maintenance in Boston that was open only to state employees and was completed by 31 registrants.⁵ The Level 2 BOC course is scheduled to be offered during the spring of 2016. The Level 1 and 2 courses cost about \$1,700 per registrant and include 74 and 61 hours of training, respectively, spread out over three months.

A recent Boston Globe article projects a need for 34,000 building and maintenance positions in Massachusetts by 2022, a significant number of which could be building operators.⁶ This represents a great opportunity for the PAs to train a whole generation of building operators to make reducing energy use a priority and provide them with the knowledge of how to participate in efficiency programs.

However, a recent study prepared for the PAs and the EEAC by Navigant Consulting found that Massachusetts ranks 17th out of the 36 states that have BOC training with respect to mean yearly number of BOC graduates per large employer.⁷ Massachusetts also lags when the total number of annual graduates is considered. Massachusetts averages 51 graduates per year, which puts it in ninth place. The percentage of students who complete the course and graduate from the program is also a concern. The PAs can only claim savings for a student if they graduate, and the course is a significant commitment in that it requires 7 full days of classroom time, passing grades on exams, and the completion of homework. The study found that there is room for improvement in graduation rates in that the statewide average is 70%, which ranks 6th out of the eight states for which there is data.

The Navigant study had several suggestions to increase the number of students and graduates. First, the Massachusetts PAs typically reach out through a limited number of channels, one or two channels, and limit the outreach to a limited number of selected customers. PAs promoting BOC in other jurisdictions use as many as four channels to promote the class and do not limit the reach through those channels. In addition, Massachusetts tends to graduate BOC students from K-12 schools at about half the rate of the rest of New England, so increased outreach to this customer type may be beneficial. Second, while the PAs offer subsidies to students for taking the

⁴ Starting in 2016, companies can sign up for a season pass that will allow them to send up to two employees to every seminar at a cost of \$199. For more information, visit <http://www.emersonswan.com/season-pass.html>.

⁵ Personal communication with Melanie Danuser, Project Manager for BOC in the Northeast region.

⁶ <http://www.bostonglobe.com/business/2015/11/08/labor-shortages-loom-training-system-ill-equipped-meet-employer-demand-study-says/AzJwULJNq4hH8F7xnRmrVL/story.html>

⁷ <http://www.theboc.info/wp-content/uploads/2015/09/Training-and-Education-Programs-Final-Report-0601915-clean.pdf>

course, certification was not required by Cape Light Compact to receive the subsidy. This policy was changed in 2014 to require certification to receive a subsidy.

COMMISSIONING OPPORTUNITIES

The PAs sponsored two commissioning trainings in 2015. The Council and DOER has indicated that commissioning is an important approach to realizing savings, and the PAs are increasing activity in this area, starting with a hospital commissioning initiative. The Consultants applaud these two trainings, and suggest that this is a great start in developing robust commissioning capacity in the state.

RESIDENTIAL OPPORTUNITIES

We also identified two opportunities that were primarily focused on the residential sector, but that may have had some spill over effect for participants who also engage with small businesses. Through MassSave®, contractors can obtain training to receive a Quality Installation Verification (QIV) certification. QIV is a third party testing procedure, administrated by COOL SMART, which verifies that installed equipment meets manufacturer refrigerant charge and capacity specifications. The full day class costs \$200 per technician, but this amount is refunded once five QIVs have been performed.⁸ In 2015, the PAs offered over 30 full day training sessions for these certifications at locations throughout the state. Since the training program's inception, 255 Massachusetts-based HVAC contractors have become certified COOL SMART QIV Trained Contractors; these contractors provide adequate geographical coverage of the entire state.⁹ The second example involves the GJA, which was established in 2010 and offers courses in weatherization training in an effort to meet the growing demand for weatherization services and to close the labor gap that is needed to provide these services. Throughout the year, the GJA holds courses to train lead crew chiefs, quality control inspectors, retrofit weatherization installers, and lead safe weatherization at the Martin Luther King Business Empowerment Center in Worcester. These courses are typically full-day sessions and cost about \$1,000 per registrant. To-date, the GJA has graduated over 400 students in those training program offerings.

Recommendations:

Based on our review of training opportunities for market actors on technical services and skills, we make the following recommendations.

- **The PAs and other stakeholders should explore options to reach market actors outside of the limited locations where trainings are currently being offered.** Much like the technology category, we observed a gap in the locational offerings of these types of trainings.
- **Promote more basic and intensive retro-commissioning engineering training.** The PAs are increasingly focused on commissioning initiatives and performance based incentives, but these efforts will be hampered by limited practitioners. This is a case where the PAs can lead the market through simultaneously increasing training and opportunity so that commissioning savings increase. The California Commissioning Collaborative has done a lot of thinking about commissioning training, and may be a good resource for planning more trainings.¹⁰
- **Continue promoting sales training in Massachusetts.** The PAs brought in Mark Jewell of EEFG in 2014 and again in 2015 to train internal staff and external vendors on how to effectively sell efficiency projects. Our understanding is that it was well received and that the PAs plan to do more of this.
- **MA EEP should offer trainings and workshops on a wide range of DOE assessment tools and audit best practices as it has done in the past.** Only steam and compressed air systems were addressed in 2015. A regular rotation of these types of trainings will elevate the professional knowledge in Massachusetts.

⁸ <http://www.masssave.com/~media/Files/Professional/Training-and-Certifications/cool-smart-contractor-training/COOL%20SMART%20QIV%20FAQs.pdf>

⁹ This map illustrates the locations of all COOL SMART QIV Trained Contractors throughout Massachusetts – <http://www.easymapmaker.com/map/ma-coolsmart-qiv-trained-contractors>. Source data from <http://www.masssave.com/~media/Files/Residential/Information-and-Edu-Docs/COOLSMART-Participating-Contractors1132015.pdf>

¹⁰ http://resources.cleanenergyroadmap.com/DMGT_M_trainingretrocommissioning.pdf

- **Offer and heavily promote more BOC training using as many as four outreach channels.** This recommendation is based on the large need for new building operator personal and the relatively low rankings of Massachusetts with respect to the BOC training. Other states cast a wider net and do not limit outreach by customer type (BOC does put a limit on size, with a 50,000 SF minimum).

Energy Efficient Technology

We identified two primary ways that market actors can receive training on energy efficient technologies. The first is through GasNetworks which offers a variety of field-based training programs on the current program offerings and the benefits of selling high efficiency equipment.¹¹ The second is through the Massachusetts Energy Efficiency Partnership (MAEEP), which is funded by the USDOE, University of Massachusetts, and the PAs.¹² We are also aware that the PAs conduct internal trainings for their own technical, planning and sales employees and that recent topics have included Energy Recovery Ventilators (ERV) and condensing boilers.

GASNETWORKS

Through GasNetworks, a variety of training and educational opportunities for contractors, engineers, designers, and wholesale distributors are offered. In 2015, Emerson Swan offered several sessions¹³ on topics including HVAC controls, hydronic systems, domestic hot water, and high tech equipment in low tech systems to over 150 attendees¹⁴ at their corporate headquarters in Randolph, MA (see Table 2).

Table 3 | Technology Training Sessions Offered Through GasNetworks, 2015

Topic	Description	Dates
Basic Electricity	This seminar is intended for technicians and equipment installers that are looking for a good overview of HVAC controls. Participants learn about zone valves and zone controls, proper control wiring, pump relay controls, and outdoor reset controls.	3/17/2015 4/22/2015 5/12/2015 6/24/2015 9/15/2015 10/27/2015 11/19/2015
Basic Hydronics	This seminar is intended for new contractors looking to gain more knowledge on the operation of a modern hydronic system. Participants learn about heat transfer principles, hydronic heating system components, piping techniques, and proper boiler plumbing.	3/17/2015 3/24/2015 4/9/2015 5/12/2015 6/24/2015 9/15/2015 10/29/2015 11/19/2015
Domestic Hot Water	This seminar explores traditional methods of generating domestic hot water including tankless coils, tank style heaters, plate exchanges and indirect water heaters. It also discusses new technological advances such as instantaneous water heaters, solar, heat pumps and hybrids.	4/23/2015 9/29/2015 11/5/2015
High Tech Equipment	This seminar explores how products have evolved into more efficient versions, new high tech hydronic equipment, and ways to increase the efficiency of older systems without abandoning them by making them smarter.	9/24/2015

¹¹ Listed on the MassSave® Professional Training & Certifications webpage and available online at <http://www.gasnetworks.com/contractor-news/contractor-training/>

¹² <https://www.maeeep.org/>

¹³ As noted earlier, these services are typically half- to full-day courses that cost \$25-\$40.

¹⁴ Personal communication with Bruce Marshall, training coordinator at Emerson Swan.

MAEEP

Through the MAEEP, architects, engineers, and other market actors have access to a variety of training and educational opportunities related to energy efficient technologies. In 2015, MAEEP held trainings in Norwood, MA on HVAC, advanced lighting controls, variable frequency drives (VFDs), and energy efficient gas technologies (see Table 3).¹⁵ In past years, MAEEP has also held trainings on opportunities and incentives for combined heat and power (CHP) and HVAC for roof-top units. They also have held earlier versions of the advanced lighting solutions and understanding and managing VFDs trainings that were held in 2015.

A key observation from our review of the opportunities offered through MAEEP is that there is a good variety of content being covered, but that the opportunities are infrequent considering the topics being covered are for high-impact technologies and practices.

Table 4 | Technology Training Sessions Offered Through MAEEP, 2015

Topic	Topics Discussed	Date
HVAC Technology Enhancements for Energy Conservation*	Programmable thermostats, outdoor air economizers, zoning systems, occupancy sensors, building automation systems, variable frequency drives, variable speed pumps, variable refrigerant flow, geothermal systems, and chiller retro-fits	1/21/2015
Advanced Lighting Solutions	Sustainable lighting solutions, best practices for lighting upgrades, retrofits vs. re-lighting with new fixtures, solid state lighting products that are market-ready, advanced lighting controls, advantages of lighting efficiency options, and exterior lighting solutions	4/23/2015
Understanding and Managing Variable Frequency Drives (VFDs)	Understand and describe the basic operational principles of VFDs; Describe advantages and disadvantages of use of VFDs and the types of applications where they can provide energy and operational savings; Understand and explain operational differences of different drive types and why certain drives are used in specific operations and others are not; Calculate potential energy savings of using drives in different applications	5/28/2015
Existing and Emerging Energy-Efficient Gas Technologies	High efficiency boilers, boiler controls, and existing and emerging boiler economizer technologies, high efficiency water heating, and combined heat and power	12/15/2015

*Note: This is the same session that was described in the technical skills and services section. We also included it here because components of the session appeared to apply to both technical skills and technology.

We also identified several new technologies that the PAs have reviewed, recommended, and described in a set of assessment documents.¹⁶ These technologies include pump controls, drain water heat recovery systems, ductless fume hoods, high efficiency commercial laundry equipment, high efficiency cooling towers, pump coating, and window glaze. While this is not considered a training opportunity, these documents include a description of the technology, its energy savings opportunity, strengths and weaknesses, and other information that might be helpful in educating market actors.

Recommendations:

We recognize that there has been a significant effort made to train and educate market actors on a variety of energy efficient and related technologies. With that in mind, we make the following recommendations.

- **Coordinated efforts between the PAs, local trade organizations, and companies should be expanded to reach market actors outside of the Boston/South Shore area, where trainings are currently being offered.** We observed a locational gap for these types of trainings.

¹⁵ As noted earlier, these are full day classes that cost \$150 per registrant.

¹⁶ <http://www.masssave.com/en/professionals/business-opportunities/assessment-of-new-efficiency-technologies>

- **Technology focused training should be promoted through channels such as e-mail blasts, radio or print ads, and outreach through trade organizations.** These trainings are currently only promoted through the MassSave, GasNetworks, and MAEEP websites. Like the BOC outreach findings, using more outreach channels should result in more interest and participation.
- **Support more trainings and best practices gatherings for niche groups such as ice rink operators, refrigerated storage, or any other specific application with high energy use.** This approach is already being employed with success in Massachusetts with wastewater plant operators, and is being considered for building facility managers.¹⁷ The PAs likely know which customers have these types of specialized facilities, so they could reach out directly to the appropriate customers.

Energy Codes

Throughout the year the PAs offer training sessions as part of their Energy Code Technical Support Initiative.¹⁸ These sessions are typically 3 hours long and are free for code officials, regulators, and program administrators.¹⁹ The goal of the training sessions is to improve the energy performance of the building stock throughout the state by educating code officials, design professionals, builders, subcontractors, material and equipment suppliers, and other market actors on a variety of topics. The building code includes many requirements that have an energy impact, so better code compliance results in energy savings. Similar efforts have concluded that code training may have an impact on compliance levels, indicating that these efforts are effective.²⁰ Furthermore, as a result of these trainings, the PAs are able to claim savings. In 2015, 13 training sessions were promoted through the MassSave website on topics including envelope and building science, mechanical provisions, and lighting provisions to nearly 450 participants (see Table 1).²¹ That these training sessions were attended by an average of more than 34 persons indicates both interest by the industry and the effectiveness of the outreach.

We observe that there are numerous opportunities for market actors in Massachusetts to engage in training sessions on the commercial energy code. In 2015, energy code trainings were separated into three topic areas, each of which was offered at least four times throughout the year. With respect to location, we noticed that the majority of the training sessions were offered in Eastern Massachusetts in the areas surrounding Worcester and Boston.

Table 5 | Commercial Energy Code Training, 2015

Topic	Description	Frequency and Location	
		Date	Location
Envelope and Building Science	Understand the building science principles regarding the focus that affect the movement of air and moisture through building assemblies and materials. The 2012 IECC provisions for envelope design and construction assist in avoiding structural and energy performance degradation in buildings.	2/12/2015	Boston
		3/24/2015	Boston
		6/11/2015	Hyannis
		6/17/2015	W. Springfield
		10/14/2015	Milford
Mechanical Provisions	Review provisions for both simple and complex mechanical systems, the importance of properly sizing and designing HVAC systems, and the code compliance obligations of the project's mechanical engineer. Other topics include proper application of code provisions for demand control ventilation and energy	2/24/2015	Westwood
		10/22/2015	Westborough
		12/4/2015	Danvers

¹⁷ <http://ma-eeac.org/wordpress/wp-content/uploads/Exhibit-1-Gas-and-Electric-PAs-Plan-2016-2018-with-App-except-App-U.pdf> page 165

¹⁸ The energy code training and event calendar is available on the MassSave® website, at <http://www.masssave.com/en/professionals/massachusetts-energy-code-technical-support/training-and-events>

¹⁹ These sessions are open to any other interested parties at a cost of \$20.

²⁰ <http://ma-eeac.org/wordpress/wp-content/uploads/Commercial-New-Construction-Energy-Code-Compliance-Follow-up-Study.pdf>, page 41.

²¹ Personal communication with Rachel Pinnons, program manager at CLEAResult in charge of oversight of the activity related to codes training for the commercial sector.

	recovery.	12/15/2015	Boston
Lighting, Lighting Control, and Other Electrical Provisions	Lighting and lighting controls in the 2012 IECC are a critical component of energy savings. New Provisions for daylight zones and outdoor lighting can be challenging to implement. Real project examples will be used to explore lighting code provisions and methodologies for calculating code compliance	Date	Location
		4/2/2015	Boston
		10/9/2015	Waltham
		11/13/2015	Worcester
		12/8/2015	Braintree

Recommendations:

- **There should be additional energy code offerings in the Springfield area of Central Massachusetts, where only one session was held in 2015.** However, we believe there is ample coverage in the content and frequency of energy code training in the C&I sector in the state.
- **In light of the expected transition to 2015 IECC in July 2017, trainings planned for 2016 should include some level of detail about any changes in the code, where appropriate.**

CONCLUSION AND RECOMMENDATIONS

The goal of this effort was to review the content, frequency, and location of trainings and educational offerings in Massachusetts to identify where coverage gaps in these areas may exist. In general, we found that the PAs and the stakeholders they work with do a good job of offering training and educational opportunities on a wide variety of topics to a diverse set of market actors. In particular, we noticed that throughout the year there was almost always a training opportunity available. The gaps that we did identify were related to the location of these offerings, and in some cases, the content.

In addition to the recommendations for the specific categories, we offer the following set of more general, overarching recommendations.

- We understand that there is an email that is sent out to a subscribers list when new training opportunities become available on the MassSave® website. We recommend that the PAs should consider broadening the list to include as many relevant market actors as is feasible.
- To the extent that this is not already being done, we recommend that training sessions, where appropriate, include discussions about the program offerings to highlight the link between the technology or approach, savings and other benefits, and participation in the programs.
- The PAs should continue and/or expand partnerships with local chapters of trade organizations and post relevant training opportunities through these outlets and on the MassSave® website.