

**Portland
Community
College**



**Department of
Apprenticeship
and Trades**

**2017
Program
Review**

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1. Program/Discipline Overview

- a. *What are the educational goals or objectives of this program/ discipline? How do these compare with national or professional program/discipline trends or guidelines? Have they changed since the last review, or are they expected to change in the next five years?*

The educational goals and objectives of Portland Community College's Department of Apprenticeship and Trades have largely remained the same since our last Program Review in 2012. We strive to advance the long-term Industrial vitality and growth of Northwest Oregon and Southwest Washington, by delivering accessible, quality education to support the academic and personal development of the diverse students and communities we have the privilege of serving. These course, degree, certificate, and State Career Pathway offerings all follow the Mission of Portland Community College. Our target communities remain large international industries and organizations, such as ESCO, Vigor, Intel, Boeing, and Solar World, as well as smaller industries and organizations such as local heating, ventilation, air conditioning, and refrigeration companies; large and small residential electrical companies, local manufacturing and processing companies, school districts, hospitals, universities, city, county, state, and even federal government organizations on occasion. We strive to support the employment base of these industries and organizations by training new technicians and upgrading the skill levels of already-employed technicians.

In order to meet these educational goals and objectives, we continue to seek out Industry professionals to teach our courses as both full-time and part-time faculty. Most of these instructors are either still working full-time in industry or have returned from retirement after a full career in Industry. This strategy, along with some help and contributions from the Apprenticeship and Trades Industry Advisory Committee, ensures that our instruction and training is current with Industry development and advancements.

Our educational goals and objectives remained focused on the same three fields of study: Facilities Maintenance Technology/HVAC-R (FMT), Electrical Trades (ELT), and Apprenticeship (APR).

Apprenticeship and Trades continues to also administer the functioning of five Joint Apprenticeship Training Committees (JATC). Limited Maintenance Electricians (LME), Stationary Engineers (SE), Manufacturing Plant Electricians (MPE), Millwrights (MW), and Industrial Maintenance Mechanics (IMM). This involves tracking on-the-job-training hours and facilitating regular JATC meetings to assure our training is consistent with industry standards, and that Apprentices in these Programs are meeting all the benchmarks outlined by the Oregon Bureau of Labor and Industry.

Facilities Maintenance Technology/ HVAC-R (FMT) program students can earn the following Degrees and Certificates: an Associate of Applied Science Degree in Facilities Maintenance Technology (FMT), a Less-Than-One-Year 44-Credit Certificate in Facilities Maintenance Technology, a Career Pathway Certificate as a HVAC-R Installer of Residential and Light Commercial Equipment, and/or a Certificate for Oregon State Bureau of Labor and

Industries Approved Pre-Apprenticeship Training, and an Oregon Career Pathway Certificate in Pre- Apprenticeship Training.

Apprenticeship students can earn the following degrees: an Associate of Applied Science in Construction Trades, General Apprenticeship, an Associate of Applied Science in Electrician Apprenticeship Technologies, and an Associate of Applied Science in Industrial Mechanics and Maintenance Technology Apprenticeship. Apprenticeship students can earn the following Certificates of Completion; Limited Electrician Apprenticeship Technologies, Electrician Apprenticeship Technologies, Manual Trades Apprenticeship, Construction Trades, General Apprenticeship, Mechanical Maintenance Apprenticeship, and Industrial Mechanics & Maintenance Technology Apprentices. Apprenticeship students can also earn an Oregon Career Pathway Certificate in the above disciplines.

There have been several minor changes and one major change to the overall educational goals and objectives of the Department of Apprenticeship and Trades. Most of those are addressed in section 1-B of this Program Review.

To gauge how well our educational goals and objectives compare with national or professional program/discipline trends or guidelines, we turn to the professionals in the Industries we serve. For Facilities Maintenance Technology/HVAC-R two of our full time faculty have attended the National HVAC-R Educators and trainers Conference for three out of the last five years since our last Program Review. This Conference is a meeting of over 600 HVAC-R educators, instructors and trainers for the HVAC-R Industry hosted by HVAC- R Excellence, the largest HVAC-R training credentialing organization in the United States. There are 60 plus Breakout Sessions demonstrating the latest in training materials and techniques and over 90 Industry Exhibitors demonstrating the latest in HVAC-R equipment, instrumentation, and tools, all in an intense three day period. All information is shared with our SAC and with all other full and part time instructors in the Department. For Electrical Trades and Apprenticeship, the members of the Joint Apprenticeship Training Committees (JATC) are all Oregon License and/or Journey Card holders working in the field and we rely on their credentials and expertise as a check on how well our goals and objectives align with their professional discipline. JATCs are composed of one-half employers and half employees, so we are afforded a cross section of Industry opinion.

b. Briefly describe curricular, instructional, or other changes that were made as a result of SAC recommendations and/or administrative responses from the last program review?

Since our last Program Review in 2012, the foremost event impacting curricular, instructional and other program changes has been the relocation of our Department. In 2014 the Department of Apprenticeship and Trades moved from the Margaret Carter Technical Education Building at Cascade Campus to the Swan Island Trades Center, a new facility in the heart of one of Portland's most vibrant Industrial areas. This trades training center is dedicated to the Programs offered by the Department of Apprenticeship and

Trades. The Department had huge input into the final design, build out, and commissioning of the Center, and were closely involved in the process of moving our existing training equipment and installing new infrastructure and training equipment.

It would be difficult to overstate the impact the new training facility has had on our program. PCC's 7.5 million dollar Bond investment into the Swan Island Trades Center has enabled significant improvements in both the quality and the quantity of hands-on training provided to our students. At Cascade Campus, we were a Trades program forced to fit into an academic facility; at Swan Island we are a Trades program that is thriving in an up-to-date, appropriately outfitted and specially designed industrial training facility. For example, we have expanded our mock-up residential framed walls for our HVAC/R Installation class and our basic wiring classes-- FMT 210, ELT 110 and ELT 210. We have also increased the variety of real world HVAC-R equipment available for use in both our residential and commercial classrooms and labs.

Our SAC has adopted another major initiative since the 2012 review that has had a major impact on our instruction. We are intentionally contributing more toward Portland Community College's mission of bringing equity, diversity and inclusion to our training and, therefore, to the whole college community. The training we provide changes lives. Graduates from our programs move into living-wage jobs with long-term futures. The Swan Island Trades Center represents a large investment from our community, and we believe, in keeping with PCC's mission, that we have a responsibility to bring access to this training to all members of our community, including those who might struggle in our regular programs. The skilled trades are one of the remaining entry-level work sectors that pay living wages, and it's important to provide access to this not only for average students but also for people who are struggling. Trades training offers students a vocational path that can be truly transformative, imparting not only technical knowledge and skills but also personal confidence and a pride of accomplishment that can change the way students see themselves.

To advance our commitment to increasing equity, diversity, and inclusion in our programs, the Department of Apprenticeship and Trades has collaborated with the Career Pathways Department to offer an integrated education and training version of the HVAC/R Career Pathway certificate--the Adult Basic Skills (ABS) HVAC/R Installer Career Pathway. This pathway prepares students for entry-level positions in the HVAC-R Industry installing residential and light commercial equipment. The ABS HVAC/C Career Pathways model is based on the evidence-based I-BEST model and pairs contextualized academic remediation with CTE instruction, allowing students to build their academic skills while progressing towards a credential. This extends the program from one full term to one and three-quarter terms, but allows students to progress in their education faster. The curricula between the CTE/ technical courses is aligned with the ABS curriculum, and the instructors work as a teaching team to help students master the content. For every technical class taught in the Program, an ABS instructor teaches a concurrently running support course. The ESOL/ABE

instructor also attends technical classes with students as needed. This program is described in greater detail in section 3b below.

Another SAC recommendation from our 2012 Review was that we expand our offerings of Apprenticeship Programs, and that we both offer the training courses and provide the Administration for these new programs. Fortunately, several industry partners, including Stimson Lumber and ESCO, approached us and asked our Department to establish a new Millwright Apprenticeship Program and a new Industrial Maintenance Mechanic Apprenticeship Program. We did so and are now in the second year for both programs.

The 2012 Review also recommended that we upgrade our existing Programmable Logical Controller (PLC) Lab with new PLC equipment. The use of PLCs, which enable automatic control and increased efficiency in the operation of commercial buildings, is continuing to increase in industry. This is a valuable skill for students to have, commanding increased wages. We estimated the costs of upgrading to be in the range of \$23,000 to \$25,000. In 2015 we were able to secure funding from a source outside the General Fund, and thanks to excellent negotiating by our faculty with the PLC provider, Allen Bradley, we were able to upgrade the PLC lab. We now have 25 current-generation PLCs in the lab, and we have added several working simulators as well. The cost was held to around \$21,000.

To advance the 2012 Program Review SAC recommendation that our Department expand our hands-on-training for Pre-apprenticeship students, various improvements have been made to the APR 200 curriculum. We have purchased a selection of the power tools commonly used across most of the Trades for use in this class, and APR 200 now includes a hands-on instructional component in addition to extensive field trips to various industry sites. The APR 200 course is one of five Pre-Trades Training Programs approved by the Oregon Bureau of Labor and Industry. Other changes to APR 200 include the option to use it as part of a 14-credit Oregon Career Pathway Certificate. Students can obtain this Certificate by adding a 4 credit Math Class (APR 162) and a 2 credit, hands-on electrical wiring course (ELT 110) to the 8 credits of APR 200.

Finally, the Apprenticeship and Trades Department has established three new Oregon Career Pathway Certificates for each of our three AAS Apprenticeship Degrees: Construction Apprenticeship Technologies, Electrical Apprenticeship Technologies, and Industrial Mechanics and Maintenance Technology Apprenticeship. These short-term credentials make our Apprentices more competitive for advancement in the work place or for securing new employment.

2. Outcomes and Assessment

Reflect on learning outcomes and assessment, teaching methodologies, and content in order to improve the quality of teaching, learning and student success.

The course outcomes within each of the Course Curriculum Outcome Guides (CCOGs) for Apprenticeship, Electrical Trades and Facilities Maintenance Technology are reviewed regularly by the SAC, the Trades and Industry Advisory Committees, and instructional staff. This review ensures both that the CCOGs meet the on-the-job needs of industry and field technicians and that they are clearly understood and readily assessable by faculty. The process is necessarily continuous due to the evolving nature of industry and the technologies involved. Many of our instructors are currently working in the field and bring their up-to-date, first-hand knowledge of industry practices and standards to the CCOG revision process. The CCOGs are also written so that instructors can readily implement and assess them in the classroom, either in written form or through student task performance. Our faculty make an effort to ensure that written assignments and practical lab exercises are based on the CCOGs and are in line with the SAC-determined lessons.

The assessment process for apprentices is a collaborative effort between PCC faculty and the supervising journey person. When the technician moves into an apprenticeship, the supervisor takes over their training, instructing and overseeing learning activities that can only take place at the job site. Assessments are conducted by the supervisor using PCC-designed evaluations, which are then filed with the PCC Apprenticeships specialist. The assessment asks supervising journey persons to rate the Apprentice in two main categories: *Ability to Communicate* and *Exhibition of Professional Competence*. Under *Ability to Communicate*, supervisors evaluate the apprentice's competency in reading, writing, speaking, listening, and visual communications. The area *Exhibits Professional Competence* consists of seven competencies: punctuality, supervisor notification of tardiness, appropriate attire, efficient use of time, adapting to feedback in a calm manner, safety of self and others, and delivery of quality work.

An entire section of the Apprentice assessment is dedicated to course-level outcomes that reflect the CCOGs. For example, apprentices are assessed on voltage drop calculations, demonstrated knowledge of recognized workplace safety standards, solving complex equations related to tasks at hand, interpretation and drawing of schematics and blueprints, setup and correct use of industrial test equipment, following standard troubleshooting procedures, applying and relating scientific theories to fellow technicians successfully, utilizing industry standards and fundamentals for discussion of repair and replacement procedures, and demonstrated knowledge of good housekeeping and correct use of tools.

a. Course-Level Outcomes

The college has an expectation that course outcomes, as listed in the CCOG, are both assessable and assessed, with the intent that SACs will collaborate to develop a shared vision for course-level learning outcomes.

- i. What is the SAC process for review of course outcomes in your CCOGs to ensure that they are assessable?*

In preparation for each biannual SAC meeting, SAC members review Course Outcomes for CCOGs in their areas of expertise. CCOG outcomes are reviewed for accuracy, focus on subject material, currency and relevance, and academic assessability. Frequent advances in industry require regular development of new labs, which SAC members evaluate for assessability both before and after implementation.

- ii. Identify and give examples of changes made in instruction to improve students' attainment of course outcomes, or outcomes of requisite course sequences (such as are found in MTH, WR, ESOL, BI, etc.) that were made as a result of assessment of student learning.*

SAC members continually review the knowledge level and skill sets of the individuals moving through our programs. The SAC makes adjustments to both course sequences and to individual courses as needed to maximize student attainment of course outcomes. As an example, many students in our program have struggled with basic math skills. To address this issue, the SAC collaborated with the PCC math department to develop a trades-specific math course for students in our programs. This course teaches students the applied math skills that technicians and apprentices use in their daily lives on the job. This course has improved the outcomes for students in their other courses, and boosted the overall retention rate as well.

b. Addressing College Core Outcomes

- i. Update the Core Outcomes Mapping Matrix.*

<http://www.pcc.edu/resources/academic/core-outcomes/mapping-index.html>

For each course, choose the appropriate Mapping Level Indicator (0-4) to match faculty expectations for the Core Outcome for passing students. (You can copy from the website and paste into either a Word or Excel document to do this update, and provide as an Appendix).

See Appendix A.

c. For Lower Division Collegiate (Transfer) and Developmental Education

Disciplines: Assessment of College Core Outcomes.

Reflecting on the last five years of assessment, provide a brief summary of one or two of your best assessment projects, highlighting efforts made to improve students' attainment of the Core Outcomes. (If including any summary data in the report or an appendix, be sure to redact all student identifiers)

N/A

Do you have evidence that the changes made were effective by having reassessed the same outcome?

N/A

Evaluate your SAC's assessment cycle processes. What have you learned to improve your assessment practices and strategies?

N/A

Are there any Core Outcomes that are particularly challenging for your SAC to assess? If yes, please identify which ones and the challenges that exist.

N/A

d. For Career and Technical Education Programs: Degree and Certificate Outcomes

ii. Briefly describe the evidence you have that students are meeting your Degree and/or Certificate outcomes.

The evidence that we have that our students are meeting their Degree and/or Certificate outcomes is contained in the Assigned Apprentice Assessments received from employers. See Appendix B for a sample Assessment.

iii. Reflecting on the last five years of assessment, provide a brief summary of one or two of your best assessment projects, highlighting efforts made to improve students' attainment of your Degree and Certificate outcomes. (If including any summary data in the report or an appendix, be sure to redact all student identifiers)

We asked 111 Apprenticeship students to have their supervising journey person fill out an assessment of apprentices comparing their performance after one year of PCC APR coursework with that of a novice apprentice. 42% of the supervising journey persons responded, and the results showed consistent progress among most Apprentices, particularly with regard to the core outcomes of professional competence and communication. After 3 terms of APR instruction, 76% of students were rated as advanced in communication, and 67% were rated as advanced in Professional competence.

iv. Do you have evidence that the changes made were effective by having reassessed the same outcome? If so, please describe briefly.

N/A

- v. *Evaluate your SAC's assessment cycle processes. What have you learned to improve your assessment practices and strategies?*

Our SAC assessment cycle has resulted in revisions to our instructional methods and delivery of subject matter.

One of the most impactful revisions has been the development of uniform lesson plans. This is an especially effective practice for courses with multiple sections and instructors. The new structure ensures consistency between classes, in student performance, and in the foundational knowledge students have when they enter apprenticeship. Cooperation between multiple instructors on the same core materials has reinforced basic instructional concepts and student understanding as measured in written and practical examinations.

- vi. *Are any of PCC's Core Outcomes difficult to align and assess within your program? If yes, please identify which ones and the challenges that exist.*

The most difficult of the PCC core outcomes to assess for our students is self-reflection. Our courses are by necessity task and competency-based, and little emphasis is placed on examination of personal beliefs or reflective self-assessment. Our programs do not address cultural awareness or self-reflection as adequately as some other programs at PCC.

3. Other Curricular Issues

- a. *Which of your courses are offered in a distance modality (online, hybrid, interactive television, etc.), and what is the proportion of in-campus and online?*

A core component of most Apprenticeship and Trades courses is hands-on work; much of this work takes place on the various training and example equipment in place at the Swan Island Trades Center. Additionally, it is vital to be able to reference real-world examples when studying technical material, both for initial comprehension and long-term retention. Consequently, distance learning is not a feasible option for most courses.

- b. *Has the SAC made any curricular changes as a result of exploring/adopting educational initiatives (e.g., Community-based learning, Internationalization of the curriculum, Inquiry-based learning, Honors, etc.)? If so, please describe.*

Two new notable curricular changes have occurred as a result of new educational initiatives.

i. Adult Basic Skills HVAC/R Career Pathway

As part of PCCs commitment to equity and inclusion, the Department of Apprenticeship and Trades has partnered with the Career Pathways Department and the ABE/ESOL departments to develop an integrated education and training version of the 14-Credit HVAC/R Installer Certificate. The ABS (Adult Basic Skills) HVAC/R Career Pathway is designed to help targeted students earn a professional credential and obtain living wage jobs. Students in this program come from a wide variety of backgrounds and face a range of barriers to educational and workplace success, including academic readiness, language ability, career changes, criminal convictions, housing instability, and health issues, among many others. The program is open to any student, but most students come through the recruitment efforts of Career Pathways staff. Internal PCC recruitment is directed at the ESOL (English for Speakers of Other Languages), ABE (Adult Basic Education), and DE (Developmental Education) programs. Career Pathways also recruits externally through government programs such as DHS Self-Sufficiency, WorkSource, and the Trade Act, and by visiting a variety of community and social service organizations, such as the Urban League of Portland, Home Forward, Constructing Hope, IRCO, POIC, Mercy Corps, SEI, alternative high schools, Human Solutions, and Central City Concern.

Students in the HVAC/R career pathway complete the standard 7-course HVAC Installer certificate, but in two terms instead of the usual one. In addition to the courses required for the certificate, students also take a support course, taught by faculty from the ABE or ESOL departments, which runs concurrently with the core HVAC classes. The curriculum is aligned and the instructors work as a team to support students' success and mastery of the content. This model allows students to progress further, faster, as it reduces the burden and cost normally required to progress through an entire series of basic skills remediation classes before starting the credit-bearing courses that will result in a college credential.

The support course provides review and practice of the material covered in the main classes, additional instruction in the "soft skills," and individualized assistance in preparing for the job market. The class is flexible, and the support instructor must adapt the curriculum to fit the particular needs of each cohort. The support instructor functions much as an academic coach for the students, and often accompanies them to the main HVAC classes. The support instructor can model good student behavior, ask appropriate clarifying questions, assist students during lab sessions, and identify both difficult subject matter and struggling students who may need additional help. This also allows the instructor to create review materials from the students' perspectives, based directly on the lessons of the day.

The support course also contains a substantial job-readiness component. Students develop communication and customer service skills, practice interview and job-searching techniques, and create a high-quality resume, references, and cover letters. Additionally, the Career Pathways employment specialist incorporates work-based learning opportunities by arranging presentations from multiple employers in the local HVAC industry. Students meet with different types of companies to gain a clearer picture of the

industry. The employment specialist also works with students to arrange job shadows with one or more companies that match their employment goals.

The ABS HVAC/R Career Pathway is currently in its third year, having run once per year since fall 2014, and has received recognition from numerous sources. The program was highlighted as a promising practice by the evaluator of the statewide CASE Consortia grant (the TAACCCT 1 grant with all 17 community colleges). It was recognized as a best practice in a recent brief by the Community College Consortium for Immigrant Education (CCCIE), and additionally by the Center for Law and Social Policy (CLASP) and the National Skills Coalition.

Data on the first two cohorts offers encouraging details. The first cohort had a completion rate of 80%, and among the completers the average GPA was 3.7. This group of students had a previous average GPA of 2.2, and included two students with a 0.0 GPA. There were 100% positive outcomes for completers, with students either going to work, persisting in college, or both. Among those entering the workforce, the average wage for employment was \$16.00/hr. The second cohort offered similar yet improved results, with fully 100% of the students completing the program and either going directly to work or continuing their education.

Overall, between the two cohorts, 89% of students completed the credential. Both cohorts had greater gender and racial/ethnic diversity than typically seen in the trades programs. The first cohort was 20% women and 53% students of color, and the second was 23% female and 46% students of color. As a comparison, the student demographics in the Apprenticeship and Trades department overall for those years were just 6% women and 32% students of color.

ii. Maritime Welding

In the fall of 2016, Portland Community College's Cascade Campus assumed responsibility for the PCC/Vigor Welding Program. The program is a unique collaboration between PCC and Vigor Industrial, offered in a leased facility at the Vigor shipyard on Swan Island. Students learn in a classroom that is literally also a work site.

In spring 2017, PCC will launch the new Maritime Welding Career Pathway Initiative in the shipyard. This initiative involves the following changes to the prior program:

- Implementation of a cohort model. Vigor Industrial requested a cohort model--as opposed to the prior open entry/open exit model--in order to synchronize Vigor hiring cycles with program graduations. This is the model used in Vigor's partnership with South Seattle Community College in the Harbor Island shipyard.
- Implementation of a two-term program to include: an approved Career Pathway Certificate, credits towards an AAS in Welding Technology, and industry certification in Maritime OSHA, Firewatch, Confined Spaces, and Forklift Operation.

- In collaboration with the Career Pathways Office and South Seattle Community College, the implementation of robust, trades-centric student support services designed to address issues of food insecurity, housing insecurity, economic insecurity, transportation, childcare and other common barriers to education.
- In collaboration with Worksystems, the development of funding streams to cover the costs of tuition, fees, materials and personal protective equipment for the entire Spring/Summer cohort.

c. Are there any courses in the program that are offered as dual credit at area high schools? If so, describe how the SAC develops and maintains relationships with the H.S. faculty in support of quality instruction?

Currently, the Department of Apprenticeship and Trades has a single dual-credit agreement with Benson High School in the Portland Public Schools District. We have had this agreement for nearly 25 years for three of our ELT courses: ELT 110 – Electricity for the Non/Electrician, ELT 125 – Basic Programmable Logical Controllers, and ELT 201 – Electrical Motor Controls. We maintain a working relationship with the HS faculty at Benson through an annual site visit and conference with the Benson Faculty person, who teaches all three courses. During this site visit we collaboratively survey and review the Lab Facilities, Syllabi, Course Content, Course Outcomes and Instructor Qualifications for the three courses. Our last site visit was in late 2015.

At the time of the compiling of this Program Review, the faculty person teaching these three courses has retired and Benson has hired a new Instructor. Unfortunately, we may not be able to continue the dual-credit agreement because the new instructor at Benson does not appear meet the Minimum Instructor Qualifications for ELT Courses. The situation is under review.

d. Please describe the use of course evaluations by the SAC. Have you developed SAC –specific questions? Has the information you have received been of use at the course/program/ discipline level?

The Department of Apprenticeship and Trades uses Course Evaluations in the spirit in which they were originally intended; as a Professional, Instructional Development tool for both Full and Part-Time Faculty. Most of the information we have received is used at the Course level.

We also have used Course Evaluations as a source of valuable information during an Oregon Bureau of Labor and Industry Review of some of our APR courses in 2013. We used this information at both the Course and Program level.

We have developed a single SAC-specific question for all of our courses in order to determine how well our training equipment complements our classroom instruction. This information has been useful at both the Course and Program level.

e. Identify and explain any other significant curricular changes that have been made since the last review.

All significant curricular changes have been mentioned above.

4. Needs of Students and community

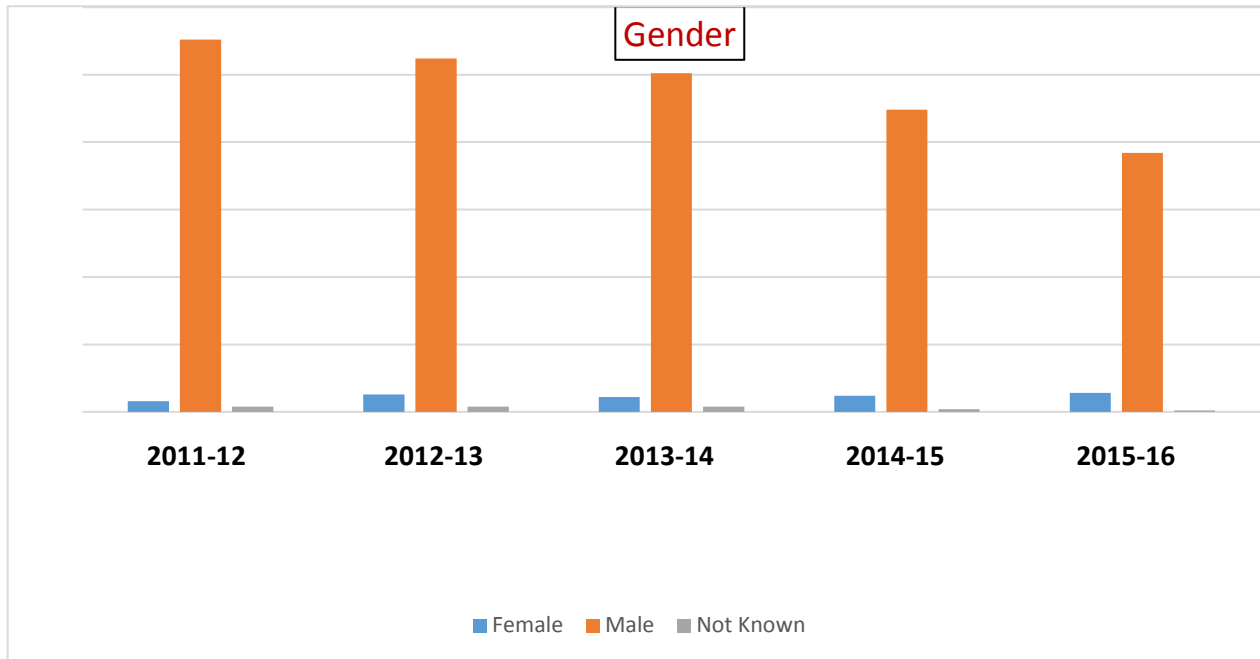
a. Have there been any notable changes in instruction due to changes in the student populations served?

According to the Office of Institutional Effectiveness, the demographics of the Trades Center students have been consistent and have seen no significant changes for the last five years (though there was a slight increase in female students).

The Trades Center staff always strive to maintain a stable enrollment and a diverse and inclusive learning environment. We recognize that inclusion has sometimes been an issue in the trades, and we actively reach out and recruit females, minority and underserved student populations, in order to help them to access and explore meaningful opportunities and careers in trades. We work closely with groups such as the PCC Women's Resource Center, Oregon Tradeswomen, Inc., IRCO, Oregon Employment Department, Outside In, alternative high schools and many other social agencies in order to improve recruitment, retention, and graduation rates, especially for students who have at times struggled to gain access and acceptance.

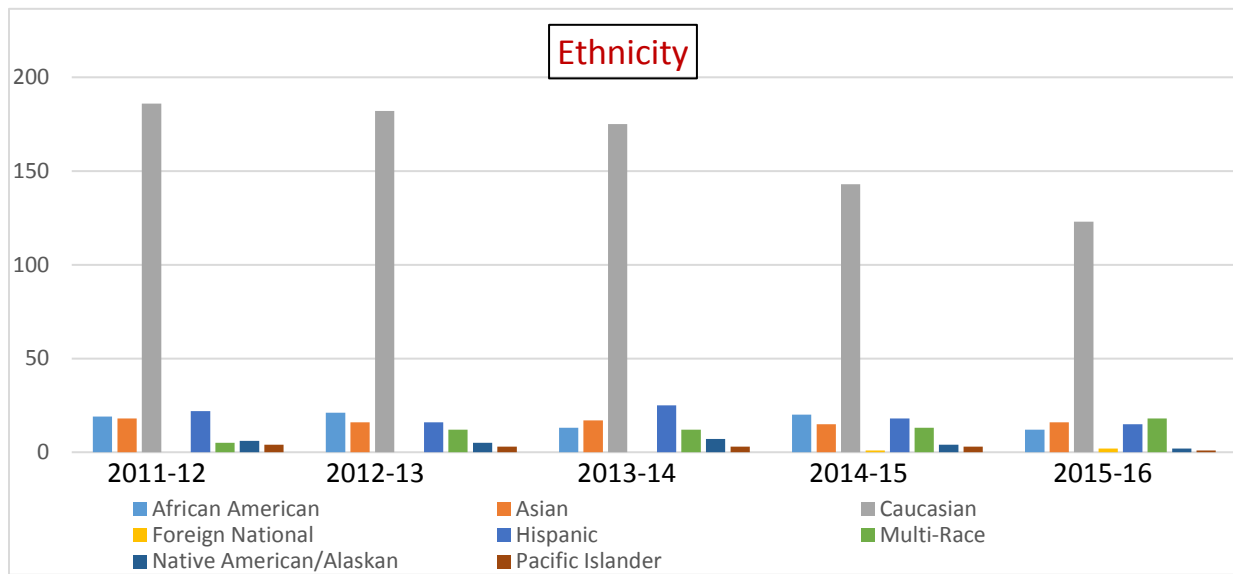
Apprenticeship and Trades Student Demographics: Gender

Academic Year										
	2011-2012		2012-2013		2013-2014		2014-2015		2015-2016	
	Count	%	Count	%	Count	%	Count	%	Count	%
Female	8	3%	13	5%	11	4%	12	5%	14	7%
Male	276	96%	262	94%	251	94%	224	94%	192	93%
Not Known	4	1%	4	1%	4	2%	2	1%	1	0%
Totals	288		279		266		238		207	



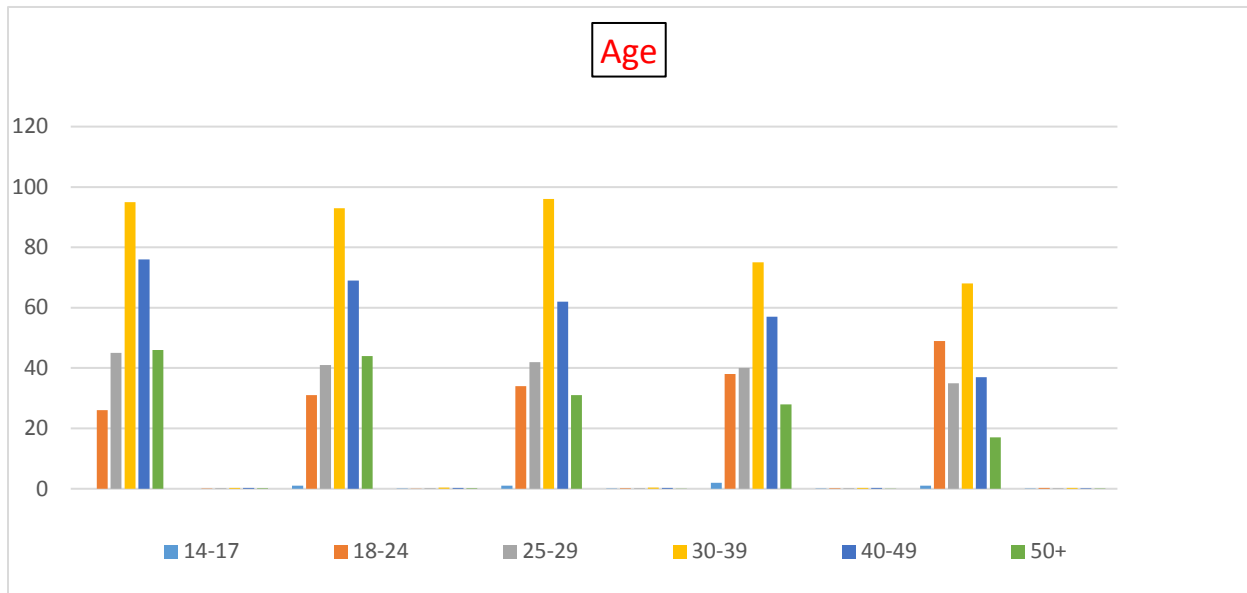
Apprenticeship and Trades Student Demographics: Ethnicity

	2011-2012		2012-2013		2013-2014		2014-2015		2015-2016	
	Count	%	Count	%	Count	%	Count	%	Count	%
African American	19	7%	21	8%	13	5%	20	9%	12	6%
Asian	18	7%	16	6%	17	7%	15	7%	16	8%
Caucasian	186	72%	182	71%	175	69%	143	66%	123	65%
Foreign National	0	0%	0	0%	0	0%	1	0%	2	1%
Hispanic	22	8%	16	6%	25	10%	18	8%	15	8%
Multi-Race	5	2%	12	5%	12	5%	13	6%	18	10%
Native American/ Alaskan	6	2%	5	2%	7	3%	4	2%	2	1%
Pacific Islander	4	2%	3	1%	3	1%	3	1%	1	1%
Totals	260		255		252		217		189	



Apprenticeship and Trades student Demographics: Age

Academic Year										
	2011-2012		2012-2013		2013-2014		2014-2015		2015-2016	
	Count	%	Count	%	Count	%	Count	%	Count	%
14-17	0	0%	1	0%	1	0%	2	1%	1	0%
18-24	26	9%	31	11%	34	13%	38	16%	49	24%
25-29	45	16%	41	15%	42	16%	40	17%	35	17%
30-39	95	33%	93	33%	96	36%	75	31%	68	33%
40-49	76	26%	69	25%	62	23%	57	24%	37	18%
50+	46	16%	44	16%	31	12%	28	12%	17	8%
Total	288		279		266		240		207	



- b. What strategies are used within the program/discipline to facilitate success for students with disabilities? What does the SAC see as particularly challenging in serving these students?*

The Department of Apprenticeship and Trades works closely with the advisors of PCC's disabilities department. Students with special needs are referred to the Disabilities Department to learn what support services are available to them and how to gain access when they need them.

Apprenticeship and Trades instructors strive to provide equal instruction to all students, including those with disabilities. The most challenging issues are when students with special needs lack the foundational skills, such as computer and math, necessary to progress in a class. To support the success of these students, instructors have increased tutoring, dedicated additional lab time, and developed extra hands-on activities.

- c. What strategies are used within the program/discipline to facilitate success for online students? What does the SAC see as particularly challenging in serving online students?*

As previously mentioned, The FMT programs offer a unique real-life working environment in industrial-grade classrooms and state-of-the-art labs. The hands-on experiences at the Swan Island Training center are a fundamental part of the education we provide, whether studying to be an HVAC/R installer, technician or manager in the facilities maintenance technology field. These courses cannot be adequately offered online.

We plan to further explore how students and instructors can use class management technology such as D2L to support their educational success in the near future.

- d. Has feedback from students, community groups, transfer institutions, business, industry or government been used to make curriculum or instructional changes (not addressed elsewhere in this document)? If so, describe.*

Feedback from students and from industry groups is very important to the Apprenticeship and Trades department. A better understanding of the needs of employers and students helps the Department to set future goals, improve curriculum, increase services and develop hands-on activities in the classroom.

Student goals in studying FMT are as diverse as their backgrounds-- searching for a new long-term career, completing short-term training for immediate employment, taking

continuing education courses for industry professionals, studying for a 2-year FMT degree, or improving skills for self-employment.

Student feedback tells us about some of the challenges incoming students face:

- Lack of knowledge about Trades careers and procedures
- Lack of resources, information and guidance
- Financial need
- Negative perceptions of the Trades as a career
- Low placement testing scores

Employers also express concerns when they discuss their employment needs:

- Skills gap--Shortage of workers with adequate technology, computer and technical training skills.
- Aging of the workforce—as older, experienced employees retire, they take their experience and skills with them. Replacing them and retaining their embedded knowledge and abilities is often difficult.

Local employers' concerns about the talent crunch are echoed in a recent study by the Manufacturing Institute and Deloitte, "The skills gap in U.S. manufacturing: 2015 and beyond." Executives surveyed indicated that deficiencies in technical and computer skills topped their list of the skills gap, followed by a lack of problem solving skills, basic technical training, and math skills.

Several initiatives have been implemented in response to student and industry feedback:

The Pre-Apprenticeship Career Pathway is a certificate program designed to prepare students who seek careers in the trades/ apprenticeship. Students build critical skills to increase their qualifications and become the most desirable applicants to one of the 40+ apprenticeship programs registered in the State of Oregon. Many of the graduates have been successfully accepted into the electrical apprenticeship programs at IBEW local 48 and Area 1.

Information Sessions

Students and their families are welcome to visit the Trades Center at any time—no appointments required. In 2015, The Trades Center has welcomed 300+ visitors (high school students, parents, educators, employers and community members). The Trades Center also offers monthly information sessions where prospective students or others can learn about program options, tour the facilities, meet and talk to faculty, and find answers to any questions. Students also get assistance to apply for admission, prepare for placement tests and register for classes.

The PCC Apprenticeship & Trades Training Award for Women and Students of Color is for students who enroll in the PCC pre-apprenticeship or trades program and represent an under-served, under-represented group in the trades. In collaboration with the PCC Foundation, over 25 Trades Center students received the award during 2015-2016. The award not only helps the Trades Center students to achieve their educational goals, it also expands the possibility of what they can accomplish in their future.

The stories of the three Apprenticeship & Trades Training Award recipients have been featured on the PCC Website:

1. Kart Dart <http://news.pcc.edu/2017/01/karl-dart/>
"New trades scholarship sets Karl Dart on path to being an electrician"
2. Salvador Castaneda <http://news.pcc.edu/2016/01/burning-bright/>
"Swan Island Trades Center opens up the world of building construction to Salvador Castañeda"
3. Rudy Martinez <http://news.pcc.edu/2015/04/rudy-martinez/>
"Rudy Martinez uses PCC to 'trade up' in careers"

Ongoing Community and Industry partnerships are continually cultivated. Employers are often invited to visit the Trades Center to learn about our programs, the types of training and skills the student are acquiring, take a tour of the facilities, meet the instructors and speak to the students about their organizations' career opportunities'. We also regularly host visits from high schools, community organizations, and business associations.

5. Faculty

Reflect on the composition, qualifications and development of the faculty.

- a. Provide information on how the faculty composition, professional development, and teaching reflect the Diversity, Equity and Inclusion goals of the institution (from PCC's Strategic Plan, Theme 5: PCC strives to provide opportunity to all students and the appropriate level of support services to ensure the highest level of success.) What have you done to further your faculty's knowledge and creation of a shared understanding about diversity, equity and inclusion?*

The Apprenticeship & Trades Department is composed of 11 staff: a full time facilities maintenance expert; a full time pre-apprenticeship and trade expert; a full time maintenance, millwright and fiber optic expert; 3 full time AP's: an apprenticeship specialist; an outreach and retention coordinator; an Outreach Coordinator; 1 full time administrative assistant and 4 part time Classroom Support Staff. There are also 36 part time faculty. All

faculty are competent workers in the Trades with many years of Journey person status. In addition, all of our faculty are talented, hard-working educators dedicated to imparting their skill, knowledge, education and training to the students assigned to their classes.

As detailed in section 3 earlier, one of the more notable initiatives of the last few years has been the development of the supported ABS HVAC/R Career Pathway certificate. This program targets minority and disadvantaged students for recruitment and academic support. The Department of Apprenticeship and Trades believes that trades training is a force that can transform lives, and through explicit inclusion, we hope to further PCCs mission and better address the needs of all community members.

b. Report any changes the SAC has made to instructor qualifications since the last review and the reason for the changes.

The Department Chair regularly reviews and updates the instructor qualifications to make sure we align with the College's standards, policies, and procedures, and that our instructors are as effective in their instruction as possible. Since the last program review, several instructor qualifications have been changed to better account for the variety of experience that our instructors bring.

Previous Minimum Instructor Qualifications for FMT, APR and ELT:

Demonstrated competency by holding a Journey card in the subject area being taught or a minimum of five years continuous field experience and/or qualifications set by licensing organization in the field;

- OR Associates degree in subject area and five years recent, full time non-teaching experience;
- OR Bachelor's degree in subject area and four years recent, full time non-teaching experience in field;
- OR, Master's degree in subject area and three years recent, full time non-teaching experience in field.
- *Instructors shall have earned required academic credential at a regionally accredited institution.

Current Minimum Instructor Qualifications for FMT, APR and ELT:

Professional / Technical Instructors in the Apprenticeship and Trades Department shall demonstrate competency / qualifications by:

- A minimum of 5 years' experience in the subject area.

A current approved license or Journey Card in the subject area is required of instructors teaching Apprenticeship required classes or license renewal classes, for any Oregon State Apprenticeship Trade.

- License Renewal Classes Currently Include: ELT 125, 126, 226, 201, 204, 220, 227, 230, 280; CEU 925P, 3168
- Apprenticeship Required Classes Currently Include: All Classes with an APR Prefix including APR 200 and any Class that is cross-listed with a Class with an APR Prefix

A current higher license or Journey Card is sufficient to teach in any lower subject area:

- An instructor with a Manufacturing Plant Electrician's Journey Card may teach Limited Maintenance Electrician courses: APR 101, 102, 103, 104, 201, 202, 203, 204.
- An instructor with a General Journeyman's License may teach Limited Maintenance Electrician (LME) and Manufacturing Plant Electrician (MPE) and License Renewal and Exam Preparation courses: APR 101, 102, 103, 104, 201, 202, 203, 204, 121, 122, 123, 124, 125, 126, 221, 222, 223, 224, 225, 226; ELT 201, 230, 220, 125, 126, 226, 204, 280; CEU 925P, 3168.

A General Journeyman's License or Supervisor's License in the subject area is required of instructors teaching licensing exam preparation classes.

- Exam Preparation Classes Currently Include: ELT 227, 230

Courses with other instructional qualification requirements:

CEU 925P Coyne First Aid/CPR for Trades:

- Instructor must have taken and passed: CEU 925M Coyne First Aid/CPR for Trades – Train the Trainer.

CEU 3168 Forklift Safety and Code:

- Instructor must have taken and passed: Operation of Class 4 Lift Trucks / Train the Trainer and must present Certification Card.

ELT 220 OSHA 30-Hour Safety Training:

- Five years of Construction Related Experience and successful completion of OSHA 510 Construction Standards Course and successful completion of OSHA 500 Train the Trainer Course (Re-certification is required every four years to maintain OSHA Authorized Trainer Status.)

c. How have professional development activities of the faculty contributed to the strength of the program/discipline? If such activities have resulted in instructional or curricular changes, please describe.

Instructors in our department often engage in professional development to meet industry needs. For example, industry is requesting the department offer General Industry OSHA rather than our current Construction Industry OSHA. This means ELT 120 and ELT 220, the OSHA 10- and 30-hour safety courses, are changing, and instructors need to be re-certified. This change will also require us to implement a new instructor qualification:

ELT 110a and 220a OSHA 30-Hour General Industry Safety Training

- Five years of General Industry Safety Experience. A college degree in occupational safety and health, a Certified Safety Professional (CSP), or Certified Industrial Hygienist (CIH) designation may be substituted for two years of experience.
- Successful completion of OSHA 511 General Industry Standard Course and successful completion of OSHA 501 Train the Trainer Course (Re-certification is required every four years to maintain OSHA Authorized Trainer Status – OSHA 503.)

This change will affect our curriculum and CCOGs will need to be updated. For example, the current CCOG for ELT 120: OSHA 10-hour safety training says a construction completion card will be awarded, which will no longer be the case. The ELT 220: OSHA 30-hour safety training CCOG has already been updated.

Apprenticeship Faculty Professional Development

All apprenticeship (APR) instructors are compliant with the Oregon State Apprenticeship and Training Council's (OSATC's) mandatory adult education and teaching effectiveness training requirements. FMT instructors were invited but it was not mandatory for them to attend. All apprenticeship faculty have completed:

- Teaching Effectiveness: Effective Instruction in the Trades, 2015
- Teaching Effectiveness: Effective Instruction, 2013
- Teaching Effectiveness: Adult Learning, 2011
- Teaching Effectiveness: Teacher-Student Centered Strategies, 2011

Additionally, all apprenticeship faculty are required to possess and maintain a current Electrical license for licensed trades such as LME and MPE. All apprenticeship instructors in non-licensed trades are required to be a master craft trade person card-carrying journeyman for their occupation. The licensed holder faculty are compliant with their license requirements that require 8-24 hours of code related and code changes classes per license renewal cycle.

Full-time faculty Professional Development

All full-time faculty have completed:

- Diversity: Skills for Collaboration, 2016
- Preventing Harassment & Sexual Violence, 2016

6. Facilities and Academic support

- a. *Describe how classroom space, classroom technology, laboratory space, and equipment impact student success.*

Specialty Laboratory Equipment and Technology

We have now been at the Swan Island Campus for three years, and we have been able to duplicate most of the programs we had at Cascade. In addition, the growth and technical improvements made to our physical facilities has allowed us to expand on most of our programs. We have several specialty labs in our department, including an Installation Lab, a Commercial Refrigeration Lab, an Electrical Motor Control Lab, a Refrigeration/Electrical Lab, a Programmable Logic Control (PLC) Lab, Electrical Lab and a Direct Digital Control (DDC) Lab.

Installation Lab - Our new Installation Lab has expanded space and a mock residential frame-up with 8-foot ceilings, allowing students to build ductwork and install equipment such as furnaces, heat pumps and air conditioners just as they would in a residence or commercial building. This hands-on laboratory is an excellent training facility, as students can apply the theoretical knowledge from their texts and classwork to real-world equipment and situations. Some of the specific skills they practice in this lab include brazing of copper refrigerant lines, wiring to electrical disconnects for equipment shutoff, building duct work from scratch, applying OSHA fall protection standards for working on elevated structures, electrical troubleshooting, and charging refrigerants into cooling equipment.

Commercial Refrigeration Lab - Our Commercial Refrigeration Lab allows students the opportunity to practice on real refrigeration equipment. For example, they can trouble shoot issues that they may face on a jobsite. Troubleshooting is a skill students can develop & practice with the classroom specialty workstations. Lab exercises are a favorite among students in addition to the many benefits derived from such a superior training environment.

Electrical Motor Control Lab - Our Motor Control Lab teaches students how to wire magnetic motor starters. This lab makes it possible for students to learn in a real and authentic way. One activity that students complete in this lab is to create issues/problems with motors and motor starters for other students to solve. This helps students prepare themselves for real work situations.

Refrigeration Electrical Lab - Our Refrigeration Electrical Lab allows students to practice wiring methods for a variety of equipment and situations in a controlled environment. Students use training boards to investigate how refrigeration electrical systems work before moving on to service actual equipment. Sequencing the instruction in this way allows students to gain confidence with whole-system wiring, and to synthesize textbook electrical theory with hands-on practice.

Programmable Logic Control (PLC) Lab - Our new PLC Lab is a computer lab that is fully equipped with both the newest PLC technology as well as legacy systems that are still in use. All controllers are connected and able to control real-life on-site equipment, such as a boiler, chiller, and a cooling tower. This is just as we would find at an industrial plant, and it allows students to learn how to use PLC's to monitor and maintain machinery in large facilities. Specialized training boards have been built so students can visualize how the programming works. Students learn to write computer programs for use in commercial, manufacturing and industrial applications. This is a specialty field, and knowledge of PLCs can raise a technician's annual wages by \$10,000 or more.

Electrical Lab – Our Electrical Lab is the is the perfect place for students to learn the wiring techniques, methods, and code required to safely make common devices like residential switches, receptacles, GFCI's, fans and light fixtures work. Both homeowners and individuals wanting to enter the electrical trades can practice wiring in a simulated residential structure made of bare wood 2 by 4 framing, much as one would find in a new construction or remodeling environment. In the initial class, students learn to wire with Non-metallic sheathed cable, the most common residential wiring material. In the second term, they study the selection, installation, and use of materials commonly used for commercial purposes, such us EMT, Metallic Flexible Conduit, and Metal Clad Cable.

Direct Digital Control (DDC) Lab – Like the PLC lab, our new DDC lab has been equipped with updated components in an effort to keep up with current technology. Connection of the DDC lab to the HVAC Equipment, boiler, chiller and cooling tower is ongoing, and when finished students will be able to practice another common method for controlling commercial HVAC systems. A large amount of connecting infrastructure and components such as compressed air, conduit and related specialty equipment are already in place. The connected DDC lab will allow students to write equipment control programs and to test those programs on live installations. DDC systems are a popular choice for companies seeking whole-facility control, and technicians with this specialized knowledge again command a wage premium.

Acquisition of new tools and equipment commonly used in the industry is an area where improvements in our classroom facilities have affected the learning of our students. One example is the Hydraulic Trainer used in the Hydraulics class. This piece of equipment provides the student with an opportunity to complete projects that demonstrate the basic principles of Hydraulics. The Locksmith class is another example. We were able to reinstate this class this winter, due to the purchase of a new Key Cutting Machine and many of the other components that make up newer locks in the industry. Availability of tools is key to implementing the most consistent student and faculty recommendation—to continue increasing practical application of the skills learned in our programs. As part of these efforts, we implemented a hands-on portion in our APR 200 Class beginning fall 2015. We purchased a wide selection of tools common to many of the trades, and we now teach students the safe and proper way to use these tools. Students complete a number of projects according to OSHA and NIOSH standards. This gives

them practical experience and builds their qualifications, and provides faculty with an additional assessment tool.

As already indicated in previous sections of this report, the largest impact on our students' success since our last program review in 2012 has been the change and improvement in our classroom space, laboratory space, and Industry-equivalent training equipment brought about by the Department's move from the previous location at Cascade Campus to our current home on Swan Island. Not only have we been able to provide students training on real-world equipment, thereby raising their technical skill levels, but also we have been able to develop valuable student assessment tools using this equipment. Our students are now more realistically prepared for entry into the Facilities Maintenance Technology/HVAC-R, Electrical, and General Construction Industries.

Another benefit of the new facility not to be understated is the fact that all classrooms are now connected to the internet. Today, manufacturers and distributors of HVAC-R, Electrical, and General Construction equipment make online replacement parts, tools, and instrumentation widely available. An enormous amount of information-- equipment specifications, service flow charts, control and power supply schematics, installation instructions, service bulletins and updates, sizing information, training for specific pieces of equipment, and safety warnings-- is just a click away. With all classrooms fully connected to the web, instructors are able to download and display an array of important technical data instantaneously. For example, an instructor in Refrigeration Electrical II is able to display, using the Classroom/Lab projector, the entire electrical schematic for a piece of equipment on which the class is working by simply inputting a model number at the manufacture's website.

b. Describe how students are using the library or other outside-the-classroom information resources. If courses are offered online, do students have online access to the same resources?

Swan Island Trades Center was not equipped with a stand- alone Computer Lab for student use. That proved to be an oversight during the Center's design and an impediment to student learning.

Thanks to much help from IT at Cascade Campus, we have updated all the computers in our Direct Digital Control Lab and have added 9 new computers and a printer. The DDC Lab now doubles as a stand- alone computer Lab with 25 general use stations open from 8:00 AM until 6:00PM daily.

- c. *Does the SAC have any insights on students' use of Advising, Counseling, Disability Services, Veterans Services, and other important supports for students? Please describe as appropriate.*

The Department of Apprenticeship and Trades SAC's one insight into the area of counseling and advising is a hearty commendation to the Veterans Services Centers at both Cascade Campus and Sylvania Campus. A significant number of US Veterans are in our Programs here at Swan Island and we have several Veterans on our faculty as well. The Veterans Services Offices has always been very supportive of these members of the PCC Community who have served us all so well. Veterans Services is quite accessible and they have always supported these former members of the Military, some of whom have undergone extreme stress and have difficulty adapting to the educational environment. Veterans Services always puts the wellbeing of the student first, and we have always been able to call on them. We heartily commend them.

7. CTE Programs

- a. *Evaluate the impact of the Advisory Committee on curriculum and instructional content methods, and/or outcomes. Please include the minutes from the last three Advisory Committee meetings in the appendix.*

Apprenticeship and Trades holds Industry Advisory Committee Meetings for both the Facilities Maintenance and the Apprenticeship programs.

It has been a long-standing practice of the Department of Apprenticeship and Trades to intentionally seek out current or recently retired Industry professionals for both full and part time faculty positions. This practice ensures that our faculty are eminently qualified, but it also has had an unplanned but beneficial impact on the functions of our Industry Advisory Committees. Many of our Part-time and all of our Full-time faculty also serve on our Industry Advisory Committees, because they are experienced, licensed, and current in the fields that they instruct. They bring industry practices, innovations, trends, challenges, history, statistics and anecdotes directly into the classroom, and they are also familiar with PCCs structure, policies, and procedures. Our Industry advisory committee is thus able to quickly assess and recommend program adjustments in response to industry developments. Because our faculty are professionals in their technical fields, their expertise benefits both daily instruction as well as program and curriculum development. Indeed, most suggestions

for new classes come from Part-time Faculty. This benefit is even more pronounced on the Apprenticeship side because the Joint Apprenticeship Training Committees also serve as the Industry Advisory Committees for the APR Related Training Classes, and appropriately so, because they are all licensed trades journeypersons, either supervisors or technicians.

b. Describe current and projected demand and enrollment patterns. Include discussion of any impact this will have on the program/discipline.

In the past three years Portland Community College as a whole has seen a district-wide enrollment drop of 10%-15%. Enrollment in the Apprenticeship and Trades Department has generally defied this trend, remaining relatively steady with occasional individual term drops in the 1%-2% range for the Department. Because demand for Facilities Maintenance/HVAC-R Technicians and for Apprentices has also remained steady, we expect this trend to continue.

The Department has seen a dramatic drop in the number of third party sponsored students, such as students receiving Trade Act or NAFTA funding. In the past seven years, third party sponsored students have accounted for as many as 40% of the students in our program. Fortunately, our overall enrollment has not been affected by this trend.

c. How are students selected and/or prepared (e.g., prerequisites) for program entry?

For the Apprenticeship Programs, students must meet the entry standards of the specific Apprenticeship Program into which they are seeking indenture. In general, 18 years of age and a High School Diploma or GED placement into MTH 60 and WR 90, and permission of the JATC are required.

The prerequisites For FMT Degrees and Certificates are placement into MTH 20, RD 90 and WR 90. For the Oregon Career Pathway Certificate in HVAC-R Installation a student must also meet with a Department Advisor and receive Department Permission. Our overall policy is to strenuously recommend that all beginning students meet with a Department Advisor for face-to-face advising, especially students with transcripts from other schools and/or military transcripts. Since our 2012 Program Review, we have added a dedicated AP position for advising and retention, and to provide the most recent information on employment opportunities. In 2014, we also completely reworked all of our websites in order to clarify and update the information about our FMT and Apprenticeship programs.

d. Review job placement data for students over the last five years, including salary information where available. Forecast future employment opportunities for students, including national or state forecasts if appropriate.

The Department of Apprenticeship and Trades does not formally track Job placements for all graduates of degrees and certificates in the FMT Program. However, we do receive a great deal of anecdotal feedback from our graduates. Here is a recent example of this kind of information from an FMT Student who came to us after taking basic classes from the PCC Skill Center program at Cascade Campus and persevering to get his FMT Degree. Note that this graduate is now in a position to help find Facilities Maintenance jobs for our current FMT students:

... I wanted to let you know that after 3 years working at the Doubletree Central Laundry as a maintenance mechanic, I left there in December to accept the Chief Engineer position at the Courtyard by Marriott in Beaverton Oregon. This is an outstanding opportunity here and I am doing quite well in this position. They are very happy with my work and knowledge and I am happy and excited to be a part of their team.

Unfortunately another opportunity has come along. This is one that I originally got my Facilities Maintenance Tech degree to try to pursue. I have been hired by the Oregon Convention Center for the position of Facilities Operating Engineer Apprentice.

I will start at the OCC on February 6, with my last day at the Marriott on the 4th. I want to speak with you about the Apprenticeship Training course at PCC as well as connecting our HR person at Courtyard in Beaverton with the Trades and Industries department at PCC. We have been having a difficult time finding candidates for maintenance positions and for my Chief Engineer position. Both would be outstanding opportunities for current students in the Facilities program.

The employment rate among students in our Apprenticeship Training Programs is inherently 100%, because all Apprenticeship Training in Oregon requires that students do their On-the-Job training simultaneously with the Related Training classes that they take here at STC. This concept was covered extensively in our 2012 Program Review.

As part of our collaboration with the Career Pathways Department at the SE Campus in the VESOL/ABE Oregon Certificate of Completion Program in HVAC-R Installation, Career Pathways reported that 80% of the graduating students in the first cohort were either employed or were continuing with their education at PCC.

In the past five years, the best employment data we have available was provided in an address by the US Secretary of Labor to the annual HVAC-R Educations and Trainers Conference, which we attended two years ago. He stated that according to US Labor Department Statistics, 53% of all Facilities Maintenance Technicians/ HVAC-R Technicians nationwide would be leaving the Industry in the next two to five years, without any solid supply of new technicians anywhere in

sight. Entry-level hourly wage for people graduating our Oregon Career Pathways Certificate of Completion in HVAC-R Installation is \$15.00 to \$18.00 per hour, and first year salary for our FMT Degree and 44 Credit less-than-one-year Certificate graduates is \$39,000 to \$42,000 per year.

e. Please present data on the number of students completing Degree(s) and/or Certificate (s) in your program. Analyze any barriers to degree or certificate completion that your students face, and identify common reasons why students may leave before completion.

The Department of Apprenticeship and Trades awarded eleven AAS Degrees in Facilities Maintenance Technology, eight 44-Credit Less than One Year Certificates, forty-five FMT: HVAC-R Oregon Career Pathway Certificates in HVAC-R Installation, five AAS Degrees in Electrician Apprenticeship Technology, and one Certificate in Electrician Apprenticeship Technology during the 2015-2016 Academic Year. Awards of Degrees and Certificates were similar for the 2014-2015, 2013-2014, and 2012-2013 Academic Years.

A huge majority of our students fall into a range between 25 years to 45 years of age. The greatest barriers that our students face in completing a Degree or Certificate are the barriers of everyday life- family obligations, the need to keep a part or full-time job, and a lack of sufficient financial resources to both attend school and pay basic living expenses. Additionally, some students struggle with the classroom environment, particularly those who are returning to the classroom after a long absence or poor initial experience. These considerations are the most common reasons that our FMT students leave before completion.

f. Describe opportunities that exist or are in development for graduates of this program to continue their education in this career area or profession.

At this time The Department of Apprenticeship and Trades has one articulation agreement in place with the Oregon Institute of Technology (OIT). OIT will accept sixty to eighty credits from our AAS Degrees (FMT and Apprenticeship) toward a four-year Bachelor's Degree in Operations Management.

There are no other agreements in development.

8. [Recommendations](#)

a. What is the SAC planning to do to improve teaching and learning, student success, and degree and certificate completion, for on-campus and online students as appropriate?

The SAC is planning to implement several new long-term training initiatives in order to maintain instructional relevance in a changing industry. We plan improvements in facilities and training equipment, detailed in section B, but the most important initiative we are planning to undertake concerns serious global environmental issues.

In 1987, the United States, along with most of the industrialized nations in the world, signed an agreement known as the Montreal Protocol. The purpose was to address potentially disastrous environmental depletion of the Ozone Layer in the earth's atmosphere caused by the release of Chlorofluorocarbons. These chemicals were commonly used as refrigerants in almost all the industrialized countries of the world, including the United States. The Montreal Protocol was successful in drastically reducing the worldwide use of Ozone-depleting CFCs, and the ozone layer has significantly recovered and is on track to fully heal by 2030. Unfortunately, the refrigerants used to replace CFCs had an unforeseen impact on a different environmental problem: global warming. Replacement refrigerants are potent greenhouse gases, some with a warming potential thousands of times that of carbon dioxide.

On October 15, 2016 the U.S. Environmental Protection Agency, along with 200 other nations, signed an agreement in Kigali, Rwanda to expand the 1987 Montreal Protocol guidelines to newer replacement refrigerants. Effectively, the signing of both these agreements means that HVAC-R Industries worldwide will be moving toward the exclusive use of refrigerants that are neither ozone-depleting or contributors to global warming. The new refrigerants include certain hydrocarbons, such as Propane and Butane, and inorganic compounds such as Anhydrous Ammonia.

Attached to this recommendation is a report, written by long-time Apprenticeship and Trades faculty member John Martin, on this worldwide changeover of refrigerants and the implications for PCCs training programs. John has taught in the Department for nearly 30 years and is currently employed by United Refrigeration, Inc. a nationwide distributor of HVAC- R equipment, parts, services, and advising for the HVAC-R Industry. John is an expert on refrigerants and their use in industry, and we are privileged to have him on our faculty. John produced his report on a request from the SAC, and it can be found in full in Appendix D. John's report concludes that the PCC Department of Apprenticeship and Trades will need to make significant investment in order to train technicians in the use of these new refrigerants.

- b. What support do you need from administration in order to carry out your planned improvements? (For recommendations asking for financial resources, please present them in priority order. Understand that resources are limited and asking is not an assurance of immediate forthcoming support, but making administration aware of your needs may help them look for outside resources or alternative strategies for support).*

As noted above, a major change in refrigerants is coming. This means that the Department of Apprenticeship and Trades will need to advance our training and certification in the use of the new, environmentally benign refrigerants such as butane and anhydrous ammonia. This changeover is particularly significant because while these new refrigerants are *environmentally* benign, they come with certain safety considerations- butane is flammable, for example, and ammonia is a respiratory hazard. This advancement in training will consequently require a significant investment in specialized training equipment as well as a new, dedicated Refrigeration Lab, detached from the main building at Swan Island for safety.

For this 2017 Program Review The Department of Apprenticeship and Trades formally recommends that PCC and the Department join in this critical environmental protection work and begin to plan for the funding, infrastructure, training equipment, and faculty professional development that will be necessary to safely train and certify our students in the use of these future refrigerants. We recommend that the department begin now to project the cost for this refrigerant program and to move forward with it as soon as possible.

A second recommendation is regarding the physical infrastructure at the Swan Island Trades Center. There is a need for an auxiliary general-use outdoor work facility on the Center grounds. While the Center has numerous dedicated laboratories and work spaces inside, we are currently limited in our ability to train students on the use of flammables and on overhead rigging, and there is sometimes insufficient indoor space for large construction projects and class labs. The Department of Apprenticeship and Trades therefore recommends the construction of an open-air, covered, multi-use structure on the grounds of the Swan Island Trades Center. This facility would be minimal in construction and unheated—likely a simple metal-framed structure— but supplied with natural gas, compressed air, and 208 volt /480 Volt 3-phase power. The facility would be general use and available to the FMT, APR, and ELT programs, as well as to the new maritime welding technology program at Vigor Industrial.

We additionally recommend that \$35,000 be added as a one-time budget augmentation for the 2017-2018 Academic year, to be used for the construction of technical trainers for our six core courses: the Refrigeration Mechanical Sequence FMT 101, 102, and 103, and the Refrigeration Electrical sequence FMT 111,112, and 113. For many years, our department has had to rely on industry donations for the training equipment used in these core courses. Much of this donated equipment is worn-out from student use. The new technical trainers would be built by our staff with student help, and the \$35,000 would provide money to purchase components.

Finally, there are two ongoing issues regarding classroom technology that need to be resolved:

- STC has 11 Classrooms. Each Classroom has similar equipment, including a Dell OptiPlex 2050 desktop computer that is integrated with a Panasonic projector, a Crestron audio amplifier, and an Aver Vision PL50 platform document camera. Although the IT equipment in each room is identical, the builds for each room are not standardized, so each instructor must learn how to use the equipment in each classroom. This impacts flexibility since if a class needs to move to another room, the instructor may not be familiar with how the equipment is set up, which could reduce the quality of the instructor's presentation. We therefore recommend standardizing the build for one

classroom podium computer, and then copying that system build to the podium computers in the other classrooms.

- The fluorescent lighting in most of the 11 classrooms is too bright and washes out the presentation on the classroom projection screen due to low contrast. Although there are multiple light switches in each room, the lighting zones are setup so that with all of the lights on, the display projected onto the screen is difficult to see. And with light switch for the light zone closest to the screen turned off, the projected display is visible, but the lighting in the classroom is then too low which impacts student attentiveness and ability to see documents in front of them (such as the textbook or student notes). We recommend obtaining and installing fluorescent light tube filters in each classroom as required (4 – 8 tube filters per classroom).

9. Appendices

Appendix A. Core Outcomes Mapping

Mapping Level Indicators:		Core Outcomes:
0:	Not Applicable.	<ol style="list-style-type: none"> 1. Communication. 2. Community and Environmental Responsibility. 3. Critical Thinking and Problem Solving. 4. Cultural Awareness. 5. Professional Competence. 6. Self-Reflection.
1:	Limited demonstration or application of knowledge and skills.	
2:	Basic demonstration and application of knowledge and skills.	
3:	Demonstrated comprehension and is able to apply essential knowledge and skills.	
4:	Demonstrates thorough, effective and/or sophisticated application of knowledge and skills.	

SAC - FMT/APR: Facilities Maintenance Technology & Apprenticeship							
Course #	Course Name	CO1	CO2	CO3	CO4	CO5	CO6
FMT 100	Intro to Facilities Maintenance Systems	4	3	3	2	0	3
FMT 131	Lock Service and Repair	3	2	3	1	0	3
FMT 201	Intro to Chiller Systems	1	2	3	0	0	2
FMT 119	Water Treatment and Distribution	1	3	3	0	0	2
FMT 207	Pneumatic Controls	2	0	3	0	0	2
FMT 202	Direct Digital Control Advanced Technology	2	0	4	1	0	3
FMT 122	Intro to Boilers	1	1	3	0	0	2
FMT 222	Intermediate Boilers	1	1	3	0	0	2
FMT 128	Oil Furnace Service						
FMT 111	Refrigeration/Electrical I	1	2	3	0	0	2
FMT 112	Refrigeration/Electrical II	1	2	3	0	0	2
FMT 113	Refrigeration/Electrical III	1	2	3	0	0	2
FMT 101	Refrigeration I	1	3	3	0	0	2
FMT 102	Refrigeration II	1	3	3	0	0	2
FMT 103	Refrigeration III	1	3	3	0	0	2
FMT 213	Commercial Refrigeration Shop	2	2	3	0	0	2
FMT 210	Basic HVAC/R Installation & Techniques						
FMT 204	Heat Pumps	1	3	3	0	0	2
FMT 125	Natural Gas Equipment I	1	2	3	0	0	2
FMT 170	Solar Photovoltaic Panel Installation						
FMT 265	Building Commissioning I						
FMT 216	Commercial Systems Design	2	2	4	0	0	3
FMT 219	Residential System Design						
FMT 280A	Cooperative Work Experience						

Course #	Course Name	CO1	CO2	CO3	CO4	CO5	CO6
APR 100	Exploring Trades & Apprenticeship						
APR 200	Trades Preparation						

APR 121	Intro to Electricity & Circuits	2	2	3	0	0	2
APR 122	AC/DC Motors Principles	2	2	3	0	0	2
APR 123	AC Theory for Motors & Transformers	2	2	3	0	0	2
APR 124	Electrical Systems Operations	2	2	3	0	0	2
APR 125	Electrical Circuits & Wiring Methods	2	2	3	0	0	2
APR 126	Electrical Systems Installation per NEC	2	2	3	0	0	2
APR 221	Advanced AC Circuitry	2	2	3	0	0	2
APR 222	Hazardous Locations	2	2	3	0	0	2
APR 223	Motor Control Operations Including PLCs	3	2	3	0	0	2
APR 224	Electrical Code - Level I	3	2	3	0	0	3
APR 225	Electrical Code - Level II	3	2	3	0	0	3
APR 226	Electrical Code - Level III	3	2	3	0	0	3
APR 101	LME: Electrical Theory Fundamentals	1	2	3	0	0	2
APR 102	LME: DC Motors	1	2	3	0	0	2
APR 103	LME: AC Motors & Transformers	1	2	3	0	0	2
APR 104	LME: Luminaries & Equipment	1	2	3	0	0	2
APR 131	Refrigeration I	1	3	3	0	0	2
APR 132	Refrigeration II	1	3	3	0	0	2
APR 133	Refrigeration III	1	3	3	0	0	2
APR 201	Electrical Motor Controls	2	1	3	0	0	2
APR 202	LME: Electrical Code - Level I	3	2	3	0	0	3
APR 203	LME: Electrical Code - Level II	3	2	3	0	0	3
APR 204	LME: Electrical Code - Level III	3	2	3	0	0	3
APR/ELT 230	National Electrical Code	3	3	3	0	0	3
APR/ELT 231	National Electrical Code II	3	3	3	0	0	3
APR 227	NEC Review & Examination Preparation						

SAC - TE: Facilities Maintenance							
Course #	Course Name	CO1	CO2	CO3	CO4	CO5	CO6
ELT/APR 230	National Electric Code	3	3	3	0	0	3
ELT 110	Electricity for Non-Electricians	2	3	3	1	0	3
ELT 210	Electricity for the Non-Electrician II						
ELT/APR 231	National Electrical Code II	3	3	3	0	0	3
ELT 150	Fiber Optics I						
ELT 151	Fiber Optics II						
ELT 152	Fiber Optics: Inside/Outside Plant						
ELT 153	Fiber Optics: Outside Plant						
ELT 125	Basic Programmable Controllers	2	0	3	0	0	3
ELT 126	Intermediate Programmable Controllers (PC Based)	2	0	3	0	0	3
ELT 225	Advanced Programmable Control	2	0	3	0	0	3
ELT 226	Basic Human Machine Interface (HMI) Program						
ELT 201	Electrical Motor Control	2	1	3	0	0	2
ELT 204	Adjustable Speed Drives	2	1	3	0	0	2
ELT 120	OSHA 10-Hour Safety Training	2	4	3	0	0	2

ELT 220	OSHA 30-Hour Safety Training	2	4	3	0	0	2
ELT 250	AMP ACT I						
ELT 251	AMP ACT II						
ELT 252	AMP ACT III						
	The courses below are taught on demand for industry partners on a contractual basis.	--	--	--	--	--	--
ELT 280	Electrical Code Changes	0	0	0	0	0	0
ELT 281	NEC Ratings	0	0	0	0	0	0
ELT 282	Grounding and Bonding	0	0	0	0	0	0
ELT 283	Code Calculations	0	0	0	0	0	0
ELT 284	Motor Controls	0	0	0	0	0	0

Appendix B: Sample Apprenticeship Assessment

Learning Outcomes/Skills Assessment Levels

Evaluation of an Apprentice should be based on comparison to entry level, first year, Apprentices who are just beginning to log OJT Hours.

Level 1- Limited

Limited demonstration and application of knowledge and skills.

Apprentice exhibits limited skill and speed, applies few learned skills and knowledge and struggles to perform task, does not complete task or requires excessive supervision from Journeyperson.

Level 2 - Basic

Basic demonstration and application of knowledge and skills.

Apprentice exhibits basic skill and speed, applies knowledge and uses developing skills to perform task, completes tasks with some supervision from Journeyperson.

Level 3 - Advanced

Demonstrates advanced comprehension and is able to apply essential knowledge and skill.

Apprentice exhibits advanced skill and speed, applies knowledge and uses proficient skills to perform task, completes task with an amount of supervision considered appropriate by Journeyperson.

Portland Community College

Assigned Apprentice Assessment

Apprenticeship and Trades

Journeyperson Evaluation

Swan Island Trades Center

Journeyperson

Apprentice

Signature

Term: Fall 2015, Winter 2016, Spring 2016

Company

Mike IHM

Core Outcomes Learning Assessment

1 2 3 ABILITY TO COMMUNICATE

- Reading - estimates, work orders, parts lists, instructions, schematics
- Writing - parts lists, supply lists, reports, email, Excel reports
- Speaking - proper terminology, appropriate interactions, verbal repair/maintenance reports
- Listening - following instructions, asking suitable questions, interaction with co workers
- Visually - using computers and other technology to convey ideas and repair strategies

1 2 3 EXHIBITS PROFESSIONAL COMPETENCE

- Is on time to work
- Alerts supervisor if absent or late
- Dresses appropriately for job setting. Uses PPE
- Uses time effectively
- Adapts to feedback calmly
- Does not endanger self or others
- Delivers quality work

I cant fault him for not using hearing protection at work where very few people do so.

Electrical Apprenticeship Degree Outcomes Learning Assessment

1 2 3

- Repair and install electrical wire devices according to licensure regulations to meet NEC and OSC.

Course Level Outcomes Learning Assessment

1 2 3

- Calculate voltage drop.
- Demonstrate safe working conditions in accordance with state and federal regulations.
- Solve electrical equations using trades specific mathematical formulas.
- Draw and interpret industrial blueprints and schematics.
- Use test equipment to make electrical measurements.
- Describe various troubleshooting techniques for trade-specific equipment.
- Use the general theories of magnetism, electromagnetism, and magnetic flux to discuss, explain, and apply the general operating principles of motors, transformers, inductors, capacitors, and generators for both A/C and D/C currents as applied to the workplace.
- Use lighting fundamentals, battery theory, trade-specific math, NEC rules for fuses and receptacles to discuss, explain, install, and repair electrical devices in the workplace.
- Use the basic principles of electrical theory to discuss, explain, and calculate how electrical current flows in conductors and electrical circuits as applied to the workplace.
- Knowledge & use of basic tools

Thank you for this survey. It reminds me of weaknesses to be addressed. - *[Signature]*

Appendix C: Ammonia and Hydrocarbon Refrigerants 2016

Prepared by John Martin for the PCC Apprenticeship and Trades SAC

TRAINING FOR AMMONIA (INORGANIC) AND HYDROCARBON REFRIGERANTS 2016

HISTORY

Vapor compression refrigeration systems first took commercial hold towards the end of the 19th century, and many different refrigerants were tried. By the 1920s, the use of refrigeration equipment had become widespread and the toxicity of refrigerants had started to cause concern, including the use of Sulfur Dioxide (R-764, SO₂, highly toxic) and Methyl Chloride (R-40, highly toxic) for residential refrigeration and commercial food preservation, respectively. The discovery and commercial introduction of CFCs (chlorofluorocarbons) in 1928 was seen as a way to standardize refrigerants and increase safety. In the years since, several refrigerants were developed to suit the changing needs of the Heating, Ventilation, Air Conditioning / Refrigeration industry (HVAC/R). R-12, the original Freon, was an early refrigerant widely used in refrigeration applications. R-22 was first introduced in the 1930s and moved into widespread use during the boom in higher-temperature residential Air-conditioning after World War II. R-115 is a low-temperature refrigerant created in the 1950s by mixing R-22 with a CFC based refrigerant, allowing for freezing temperatures below -49° F and making it useful for food preservation. Since 1928, we have mainly used these three refrigerants for all of our refrigeration and air-conditioning needs.

In 1974 it was discovered that CFC (chlorofluorocarbon)-based refrigerants were damaging the earth's protective Ozone layer. The 1987 Montreal Protocol was an unprecedented international agreement to address this global problem with a graduated phase out of all CFC (chlorofluorocarbons) refrigerants.

As CFC refrigerants began to leave the marketplace, new refrigerants were introduced to safely replace them. This next generation of refrigerants were called HCFCs (Hydrochlorofluorocarbons). HCFCs were meant only as temporary substitutes until long-term replacements for the ozone-depleting CFC refrigerants could be created. These temporary HCFC refrigerants had significantly lower ozone-depleting properties, but high Global Warming Potential (GWP). GWP, the measure of a particular substance's ability to contribute to global warming, is measured in comparison to carbon dioxide, which has a GWP of 1. HCFC refrigerants, in contrast, had GWP scores ranging from 10,000 to 35,000. HCFCs are under active phase out and are often retrofitted to use HFC refrigerants, described below.

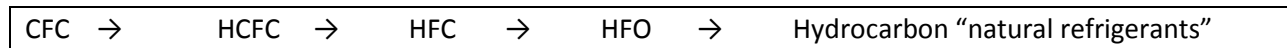
The rapid changes in the refrigerant technology industry mean that technicians need to be familiar with both new products and a variety of older refrigerant systems. At Portland Community College's Swan Island Trades Center, we teach students about the 35 most common refrigerants we regularly encounter as tradespeople, and this is only a portion of the 161 refrigerants and compounds in use today for Refrigeration and Air Conditioning (ASHRAE/ANSI 34-2013 Designation and Safety Classification of Refrigerants; Updated 9/7/2016).

TODAY-

The most environmentally friendly group of inorganic refrigerants in use today are the HFCs. These refrigerants have replaced HCFCs in new equipment and are also used to retrofit old equipment. While

HFCs are a great improvement over previous refrigerants in terms of environmental impact, they are still potent greenhouse gases. To fight global climate change caused by these insulating greenhouse gases, a new group of refrigerants is being introduced today; Hydrofluoroolefins (HFOs) which have even lower GWP values. Most HFOs have a GWP far below the EPA's threshold for environmentally safe refrigerants- 1500.

The historical progression of refrigerant use and transition is illustrated here:



Meanwhile, it's known that [there are more than 80 refrigerants](#) under active research and development worldwide. Many of these are HFOs or are a component of a new HFO refrigerant blend. That means we will need new training and that the equipment we use for Air conditioning and Refrigeration must be re-rated and approved by the manufacturer and Underwriters Laboratory for safety and electrical compliancy. It also means our in-house work stations and labs will need to be expanded for training purposes.

LUBRICANTS-

The CFC refrigerants that we have used from 1928 to today use petroleum-based (Mineral Oil) lubricants for the compressors and system parts that need lubricating. This all changed with the implementation of the HCFC, HFC, and now HFO based refrigerants. They require a very expensive compressor lubricant-oil called Polyol ester (POE, a synthetic product).

One unique characteristic of POE is that it is exceptionally Hygroscopic (moisture absorbing), and it is easily contaminated if not installed or maintained correctly in the system. Training on this oil alone takes one to two class sessions. When the oil absorbs moisture, it breaks it down to its base chemicals and is no longer an adequate lubricant. Unfortunately, there is usually no one in attendance when this happens in the compressor. Without a lubricant, the failure of the compressor is imminent.

(****An ester is the product created by the chemical reaction of an organic acid with an alcohol. This can be simply shown as follows- Organic acid + alcohol → heat → ester → water ****)

On October 15, 2016, in Kigali, Rwanda, the U.S. Environmental Protection Agency and 200 other nations signed an agreement adding to the 1987 Montreal Protocol guidelines. In this case, however, they are banning or reducing the manufacture of HCFC and HFC refrigerants by reducing their production. This is due to their very high GWP values, ranging from 4,500 to over 10,000.

The agreement set a lower world-wide GWP tolerance value of all refrigerants from 30,000 to under 1500 GWP. (Carbon Dioxide = 1 GWP value) This eliminates almost all of the "new" refrigerants that have been created in the last 19 years. It's not clear how long the current refrigerants will remain in use under EPA rules. A few are slated to be dropped from production in 2030 and a few more in 2045.

FUTURE-

The situation described above is creating an opportunity for two “currently in use” refrigerants; Hydrocarbon-based and “inorganic-based”. Energy efficiency is a paramount consideration using these refrigerants. (See chart A below)

Refrigerant R290* (Butane) and R600a (Isobutane) has been used as a refrigerant since the mid 1800’s. (Bitzer and Danfoss Corporations; European compressor manufacturers make R290 compressors). True® Manufacturing*** (an American manufacturer of refrigerated food display cases) has been using R290 in their refrigerated display cases (similar to the case in room STC124; it has R134a in it) since 2013. Butane (R290) will require some new training however. Currently that are no Federal or State Certifications required or certified classes for training but, RSES** (Refrigeration Service Engineers Society) has training and a “certificate” for it.

Inorganic Refrigerants-

PCC has held classes on Anhydrous Ammonia (R717) in the past, though today we usually see Anhydrous Ammonia (R717) used only in a commercial facility due to the Mechanical Codes and city guidelines limiting the quantity of the refrigerant allowed on site.

The bulk of training for these two refrigerant groups will be handled in a classroom setting. Advanced classes will then require hands-on practice in shop settings or a “containerized” shop.

Current guidelines and laws for any refrigeration system utilizing Butane (R290) state that the system charge cannot exceed 5.3 ounces (150.2 grams). This is why, though it is very efficient and uses a smaller horsepower compressor, refrigerated cases will require 2 compressors. This gives it a “staging” capacity and prevents both compressors from running at the same time except under maximum loads. Butane systems are thus very energy efficient.

Ammonia (Anhydrous Ammonia, R717) has been used as a refrigerant since 1918 in the United States. Its high BTU value (British Thermal Units; 598 BTUH per pound) makes it one of the most efficient Natural refrigerants in use today. Ammonia is found in any Recreational Vehicle or trailer that has a refrigerator/freezer, and it has been in use since the 1950s on these systems. Ammonia is in much more common use than one might think.

We will need a training facility to accommodate these three refrigerants, first and foremost for safety training, and then to apply the students’ knowledge from the classroom sessions.

CHART A

Refrigerant	Heat of vaporization /Lb. (efficiency)	GWP	Status
R-12 CFC	71.2 BTU	10,910.0	No longer available
R-22 HCFC	100.5 BTU	1,810.0	Phase out 2020

R-407C HFC^*	100.8 BTU	1,610.0	EU Phasing out 2018-21
R-404a HFC^*	86.1 BTU	3,920.0	EU Phasing out 2018-21
R-717 Anhydrous Ammonia	598 BTU	0.0	In use today, world wide
R-507 HFC	84.35 BTU	3,985.0	EU Phasing out 2030
R-290a Butane	*****165.2 BTU	3.0	In use today, world wide

While both propane and butane are hydrocarbon gases, propane has the chemical formula C₃H₈, while butane has the chemical formula C₄H₁₀. Propane has a boiling point of approximately minus 44 degrees Fahrenheit, while butane has a boiling point of 30 to 34 degrees Fahrenheit, making propane more useful as a fuel in colder weather.

R744 (Carbon Dioxide) CO₂, has also been selected as a modern refrigerant but there are two issues concerning its use: 1) it is usually used in Supermarkets with a Glycol brine or “secondary refrigerant” and found not to be energy efficient; 2) the product R744 - CO₂ is created chemically, not removed from the compound air that we breath. Therefore, in the event of a leak, it adds to the trapped greenhouse gasses effect.

Appendix D: *Apprenticeship and Trades Industry Advisory Committee meeting minutes*

i. January 25, 2017

Attending: Katrina Cloud, Jim Coppernoll, John Brown, Mike Fitzgerald, John LeCarno, Jason LaTour, Laurence Osborn, Paul (Joe) Shumate

Curriculum Discussion: Should APR 201: Electrical Motor Control and ELT 201: Electrical Motor Control be two different levels?

- The advisory group is questioning if Electrical Motor Controls should be a beginner class for FMT students and build an advanced class for apprentices.
- Apprentices have reported they cannot do a basic one-line diagram.
- Larry Osborn states the instructor is covering this.
- The committee has also heard APR 201 is a 'skate' class.
- Larry Osborn adds there are FMT students in the class that are not apprentices so maybe the class is at a FMT credit level but the instructor could discuss that.
- John LeCarno says he has asked a handful of times to have the class turned into a lecture class so his curriculum would not have to be so fast paced.
- Katrina Cloud suggests discussing the curriculum with the instructor and the department chair.
- John Brown and John LeCarno are to meet, discuss and report at the next meeting.

ii. February 10, 2017

Student Union Building, Cascade Campus, Room 203

Industry Advisory Committee Members:

Erik Scholibo –Johnstone Supply

John Martin – United Refrigeration, Inc. and FMT/HVAC-R PT Faculty

Tim Hodgson – Pyramid Heating and Cooling and FMT/HVAC-R PT Faculty

Enrique Maldonado – Former Facilities Electrician at PSU and FMT/HVAC-R FT Faculty

John Shaw – FMT/ HVAC-R and Millwrights FT Faculty

Dennis Cook – Former Intel Facilities Technician and FMT/HVAC-R PT Faculty

Brain Zomolek – Current Intel Facilities Manager and Technician and FMT/HVAC-R PT Faculty

Burke Thornburg – PCC Facilities Management Services Supervisor

James McCarthy –Energy Manager, VA Medical Center, Portland

Rick Durbin – PCC HVAC-R Technician and FMT Coop Work Supervisor

Sal Castaneda – Industry Outreach Coordinator at Swan Island Trades Center

Richard Willebrand – Department Chair and FMT/HVAC-R FT Faculty Swan Island Trades Center

The meeting was called to order at 7:45 AM on Friday, February 10, 2017.

11 of 13 members were present.

Richard Willebrand, Department Chair and Committee Chair provided an overview of the FMT/HVAC-R section of the Department of Trades and Industry highlighting the most recent initiatives such as the VESOL/ABE Installer Program and the issues to our instruction because of the recent Refrigerant Protocol held in Kigali, Rwanda

The Chair introduced two changes to our FMT Degree in effect this 2016-2017 Academic year: a stand-alone CTE Math Class, APR 162 – Calculations for the Trades to meet Basic Competency in Math and replacement of BA 131- Computers in Business with CAS 133 – Basic Computer Skills as the computer class. Both classes are now required for the FMT Degree. The Committee had unanimous consent in favor of both classes and thought the introduction of a stand-alone CTE Math Class to meet Basic Competency in Math was long overdue.

The Committee reviewed the results of a Self-Examination exercise from the Apprenticeship and Trades October 26, 2016, SAC Meeting. The Self Examination report is attached to these minutes and the Committee thought this exercise was very valuable and that we should do it annually.

There was a general discussion brought about by this report:

The Committee would like the SAC to explore a ‘Service Dispatcher’ option in the FMT Degree.

The Committee would like the SAC to review the Lecture to Lab ratio in all of our courses looking to add more lab/hands-on instruction.

The Committee would like to see better liaison between the Department and HVAC-R Service and Installation Companies, and HVAC-R Distributors

The Committee would like the Department to better advise FMT students about the detriment to employment if a student does not have a valid Driver’s License.

The Committee would like the SAC and Department to investigate the value of offering Industry “Building Operations” Certificates.

The next meeting of the Industry Advisory Committee was set for some time in the week of June 12-16.

The meeting was adjourned at 9:00 AM.

iii. Industry Advisory Committee Meeting: Self-examination results

At our last Subject area Committee Meeting, October 26, 2016, the Department did a self-examination using the following three questions:

With students in mind, what does our Department do best?

With students in mind, what does our Department do poorly and need to improve?

With students in mind, what are the best five initiatives we accomplished in the past five years?

Here are our reflections:

Do Best

- We have established a dedicated training center.
- We have maintained steady or improved enrollment and have only seen a 1%-2% drop compared to 10-15% for the district
- We have successfully sought out and hired Industry professionals to instruct our courses
- We have supported our students in the field after graduation
- We have kept our instruction current with changes in Industry.
- We have employed instructors who are passionate about passing on their trade, who are helpful and accessible, and who pride themselves for quality workmanship.

Do Poorly

- We need to increase hands-on-training.
- We need to include more nuts and bolts Labs to complement our lectures.
- We need to provide more consistency in instruction especially where different instructors teach the same class.
- We need to provide more consistency in the Lab work in classes among different instructors.

Best Initiatives

- We have established Train/Trainer classes.
- We established a scholarship program targeting underserved populations in the Trades.
- We have responded directly to Industry by starting the Millwright/Industrial Maintenance Mechanic Apprenticeship Programs.
- We have collaborated with Career Pathways to establish the VESOL/ABE HVAC-R Installers career Pathway Certificate Program.
- We have responded quickly to the 2016, Kigali, Rwanda Protocol to prepare for the use of "Inorganic Based" and "Hydrocarbon Based" Refrigerants.

iv. March 23, 2016

Attending: John Brown, Katrina Cloud, Jim Coppernoll, Mike Engh, John LeCarno, Jason LaTour, Laurence Osborn, Paul (Joe) Shumate

Curriculum Discussion

Should OSHA curriculum cover 1910 General Industry Regulations or 1926 Construction Regulations?

- APR 103 includes OSHA 10-Hour certification. The curriculum states Safety but does not specifically require the safety certification.
- Should OSHA 10 be extracted from the course and the program can go back to a standalone course; maybe a weekend class.
- Many apprentices have OSHA 10 or OSHA 30 already so this change would allow the their apprenticeship program the ability to allow suitable substitutions.
- The Instructors support the change and requests to use 1910 OSHA (general industry) instead of the current 1926 OSHA (construction industry).
- The department confirms the Course Content Guide outlines the curriculum requires 10 hours of safety but does not specifically state the safety needs to be OSHA safety.
- The department also confirms the OSHA taught by the department is currently OSHA 1926 for the Construction Trades.
- The department would bring forward the industries recommendation to the SAC.
- Industry proposes the OSHA 1910 be taught on Saturday in a two day, 5 hours each day format as a required class.
- For the apprentices that have completed the OSHA 1910 or 1926 OSHA 10 or OSHA 30 certification, the Apprentices can submit an original certification card to the Administrator. If the certification can be authenticated, the Administrator will place a copy in the Apprentice file and apply it as a substitution toward the apprentices' completion plan.

PLC Elective Discussion:

- PLC classes have an online component.
- Apprentices are attending 30-33 hours of in class time but some instructors allow lab assignments, quizzes, mid-term and final exam to be taken outside of class through PCC's Desire to Learn platform.
- Instructor's teach differently:
- Mr. Roger Kozera is the main instructor using Desire to Learn.
- He attended the Pacific NW Industrial JATC to discuss how he uses the software.

- Instructor, Mr. Doug Miller reports he only houses his class notes and PowerPoints through the software.
- The third instructor was not consulted.
- The instructors agree to one (1) timed mid-term and final exam for apprentices. As such, the Committee approves ELT 125: Basic PLC, ELT 126: Intermediate PLC, and ELT 225: Advanced PLC as Hybrid classes on the approved elective list, effective 3/15/16.

