

Pathways for Alternative Energy Automotive Technicians Year 1 Interim Report

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July 2017

Executive Summary

Columbus State Community College (CSCC), with funding from the National Science Foundation's Advanced Technical Education (NSF ATE) directorate, is creating an Alternative Energy Automotive Technology career pathway. By developing new technicians and elevating the existing workforce, the project aims to: 1) increase the supply of skilled technicians by creating a pathway from high school to two-year, and potentially four-year degree programs and/or employable exit points; 2) expand the pool of qualified students entering the automotive program from various and non-traditional backgrounds by involving targeted high school students early in STEM; 3) increase the number of students enrolled in the Automotive Technology program at Columbus State; 4) disseminate the model regionally for replication at other institutions; 5) expand existing TechLINK Cooperative Work Experience with an additional focus on alternative energy diagnosis and repair; and 6) provide professional development for teachers/faculty and engage additional high school faculty in alternative energy automotive technology education.

During Year 1 of this project, the project team implemented the tasks outlined in the proposal. In consultation with industry leaders, they performed a compression planning process that identified relevant skills and knowledge needed by workers in Alternative Energy Automotive Technology careers. Additional activities included: holding Industry Leadership Team meetings, participation at The Midwest Green Fleets Forum & Expo, planning and recruiting participants for the summer First Responder Workshop to address safety concerns in Alternative Energy Automotive Technology, and coordinating a professional development opportunity at the Ohio Automotive Instructor Workshop to spread awareness of the field to high school faculty. Finally, student recruitment strategies were also developed and will continue into Year 2 of the project.

As the project enters its second year of funding, the project team should continue to implement the project activities while soliciting feedback from industry and recruiting students into Alternative Energy Automotive Technology.

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Background

Columbus State Community College is working in collaboration with Clean Fuels Ohio, the Center for Automotive Research at The Ohio State University, local high school districts and technical centers, several industry partners, and previously awarded NSF ATE projects at Owensboro Community & Technical College, Macomb Community College's Center for Advanced Automotive Technology (CAAT), and the Center for Aviation and Automotive Technical Education using Virtual E-School (CA2VES) at Clemson University to implement a career pathway in Alternative Energy Automotive Technology and related curriculum. The curriculum will optimize emerging techniques and technologies including project-based learning, integrated learning objects, and a STEM-intensive curriculum that incorporates education in technology, engineering, automotive, and mathematics to prepare a technical workforce appropriately educated to support the increasing market for alternative energy automotive technicians.

The skills required for an automotive technician continue to advance with innovations in the automotive industry and increased computerization of systems. To meet these new demands, technicians must have strong academic and diagnostic skills. Emerging trends in hybrid and alternative energy technology have led to a shortage in the high skilled and journeyman workforce. By developing new technicians and elevating the existing workforce, graduates can secure high wage positions as alternative energy automotive technicians. Therefore, the project has the following six (6) objectives:

1. Increase the supply of skilled technicians by creating a pathway from high school to two-year, and potentially four-year degree programs and/or employable exit points.
2. Expand the pool of qualified students entering the automotive program from various and non-traditional backgrounds by involving targeted high school students early in STEM.
3. Increase the number of students enrolled in the Automotive Technology program at Columbus State.
4. Disseminate the model regionally for replication at other institutions.
5. Expand existing TechLINK Cooperative Work Experience with an additional focus on alternative energy diagnosis and repair.
6. Provide professional development for teachers/faculty and engage additional high school faculty in alternative energy automotive technology education.

A total of four (4) modified courses will be enhanced with an additional focus on alternative energy leading to the AAS Degree in Automotive Technology and Master Automotive Service Technician Certificate (MAST). Further, two (2) new courses for Hybrid and Alternative Fuels (CNG, H2, etc.) will be developed, leading to a new Alternative Energy Automotive Technology Certificate. Students will also work in the school's automotive lab located on the main campus (see Figure 1). This lab is an automotive maintenance and repair lab where students have opportunities to work on various cars (i.e., hybrids, electric plug-in, and CNG-powered engines) from local dealerships (either purchased by or donated to CSCC). For a pictorial overview of the project, see the Project Pathway (Appendix A).



Figure 1. Automotive Lab at CSCC.

Additional deliverables include: a summer workshop for first responders to understand safety concerns with hybrid and alternative fueled vehicles and a fall workshop for high school faculty to understand emerging trends in alternative energy automotive technology education.

During the term of the grant, at least 72 individuals will be prepared to enter the industry with an ongoing pipeline of at least 100 students per year thereafter. Over 60 high school faculty members and 60 first responders will participate in alternative energy-focused workshops.

Purpose and Design of the Evaluation

The project team has contracted with The Rucks Group to provide external evaluation services. The Rucks Group is a six-person research and evaluation firm that gathers, analyzes, and interprets data for clients to measure the impact of their work. The firm provides external evaluation services on several large, multi-year projects funded through the Department of Labor (DOL), National Science Foundation (NSF), and other grant funding agencies.

The evaluation has a two-fold purpose: 1) to capture information regarding the activities of the project (formative evaluation); and 2) to assess the outcomes of the project (summative evaluation). Key elements of the evaluation are the project logic model, its objectives, and the evaluative questions. The logic model is a visual overview of the project's hypothesis on how it will achieve its goals. The logic model (see Appendix B) provides the frame for the evaluation while the evaluative questions guide the nature of the data to be collected. The theory of change underlying the project is that if a quality curriculum in alternative energy automotive technology which aligns with stated industry needs is established and if high school students, women, U.S. military veterans, and minorities are made aware of the existence of the program and opportunities available in the field, then the number of individuals serving as alternative energy automotive technicians will increase.

The evaluative questions to be addressed over the life of the project are:

1. How effectively is the project being implemented? What obstacles are being experienced? To what extent are the stated goals and objectives being achieved?
2. How was the pool of qualified students entering the automotive program expanded? To what extent was the pool expanded by students drawn from non-traditional backgrounds?
3. To what extent is the model being disseminated regionally? How is the model being used by other entities?
4. How satisfied are teachers and faculty with professional development activities? To what extent are teachers and faculty incorporating lessons learned from professional development activities into their classrooms?
5. What is the projected budget versus the actual expenditures? What is the estimated return on investment of the grant funds?
6. What were the significant unanticipated outcomes?

The external evaluation team works closely with the project team to ensure that all aspects of the evaluation are completed. Specifically, the project team is gathering baseline data, establishing and monitoring data collection efforts, and providing formative data analyses. The project team provides requisite college data to the external evaluator through secure data transfer channels. Data collected directly from students will follow institutional IRB guidelines.

As the project finishes its first year of funding, the work to-date has primarily focused on conducting job skills analysis using compression planning with the Industry Leadership Team, modifying existing courses, holding Industry Leadership Team meetings, designing the first responder workshop and recruiting workshop participants, and identifying high school faculty to participate in the professional development workshop. As such, the evaluative questions addressed in this report relate to evaluative questions 1 and 2. The third, fourth, and fifth evaluative questions will be included in subsequent reports.

Findings

Evaluative Question #1: How effectively is the project being implemented? What obstacles are being experienced? To what extent are the stated goals and objectives being achieved?

The primary activities for Year 1 revolved around conducting a job skills analysis with the Industry Leadership Team using the compression planning methodology, modifying existing courses, holding Industry Leadership Team meetings, designing the first responder workshop and recruiting workshop participants, and identifying high school faculty to participate in the professional development workshop. Implementation of these activities is proceeding and has met no major obstacles. Further, the project is ahead on their implementation timeline as it relates to the incorporation of the Snap-on equipment into the curriculum. Each task is discussed in further detail below.

Compression Planning with Industry Leadership Team

The development of the curriculum included working with industry partners to determine the appropriate content using a compression planning method (McNellis, 2009). The project team reported that use of the compression planning method was a highly-effective and efficient process in extracting necessary job skills data and information from key industry partners.

As a result of the compression planning session, the alternative energy automotive technician pathway was developed by leveraging the existing curriculum with modified advanced alternative fuel preparation coursework. Specifically, four (4) courses were modified including, a) Hybrid Vehicles: Theory & Operation; b) Electrical Systems: Theory & Operation; c) Engine Performance: Theory & Operation I; and d) Engine Performance: Theory & Operation II. By completing this succession of courses and additional automotive technology coursework, the pathway culminates in the completion of an AAS Degree in Automotive Technology and Master Automotive Service Technician Certificate (MAST).

Additionally, two courses for Advanced Hybrid and Alternative Fueled Vehicles are being developed to lead to a new Alternative Energy Diagnosis & Repair Certificate. These two courses are: a) Hybrid Vehicles: Diagnosis and Repair; and b) Advanced Alternative Fueled Vehicles: Diagnosis and Repair.

Industry Leadership Team meetings

CSCC modified the existing industry advisory committee to form the Industry Leadership Team. The Team is comprised of individuals in various leadership roles within their organizations (i.e., CEO, President, Executive Director, and Manager). The industries represented include: Germain Motor Company, Clean Fuels Ohio, CNG Trans LTD, Haydocy Automotive Inc., City of Dublin, Ricart Automotive, and The Ohio State University Center of Automotive Research (OSU CAR).

The Team meets quarterly to review and monitor progress toward achievement of the program's objectives. Additionally, the Team will file a formal accomplishment report annually. Three (3) of these meetings are held virtually, while one is face-to-face. To keep the team current and growing, the project will target expanding the Team by an additional new member each meeting. Utilizing this approach will promote industry investment in the project and curriculum, allow CSCC to leverage the industry partners to hire student completers, and develop first-hand connections between faculty and industry partners.

Certificate Approval

To formally offer and enroll students in a certificate program, the program must gain approval from three entities: internally at CSCC, as well as externally from the Ohio Department of Higher Education (ODHE) and the Higher Learning Commission (HLC).

Internal at CSCC

Within the internal approval process at CSCC, two components are required. The first is the Pre-Approval component where the basic information of the certificate curriculum is presented and reviewed by the Department Chair, the Division Dean, the Accreditation Liaison Officer, the Dean of ASC, and the Senior VP of Academic Affairs. This will be in the form of a Certificate Proposal outlining the program outcomes to act as an overview of the approach and timeline. This Certificate Proposal is currently being finalized.

Following the completion of this stage, the curriculum and any necessary supporting documentation is submitted for review and approval by a number of groups (i.e., Department Curriculum Committee, the Division Curriculum Committee, the Division Dean, the OAA Curriculum Committee, Curriculum Management, and the Senior VP of Academic Affairs). Documentation describing any major changes occurring must be submitted by September 1st. The project is preparing this documentation because the 2190 Hybrid Electric I course is being modified more than originally expected. Specifically, the proposed course is being reduced from a two (2) credit course to a one (1) credit offering as the proposed curriculum fits better within that structure. Finally, the project team is confirming the addition of the two (2) new courses (as previously mentioned), which must be submitted by October 1st. Once each approval at CSCC is granted, the certificate curriculum may be submitted to ODHE.

External through ODHE

To receive Technical Certificate designation, a certificate must align to an industry-recognized credential. This will be completed following approval Internal CSCC approval (mentioned above). The ODHE Certificate review and approval process typically takes 2-4 months for completion.

External through HLC

After receiving internal and ODHE approval for a new degree or certificate, the HLC requires that institutions apply for and obtain prior HLC approval for proposed changes submitted through the office of the Accreditation Liaison Officer. The HLC notes that it takes an average of 90 days to six months to process substantive change applications depending on the complexity of the change request.

Participation at The Midwest Green Fleets Forum & Expo

To continue leveraging their relationship with industry, the project team has agreed to participate in The Midwest Green Fleets Forum & Expo in Columbus, Ohio on August 2, 2017. In conjunction with Clean Fuels Ohio, this opportunity will allow the project team to represent the Automotive program at CSCC and meet with hundreds of fleet representatives from across the Midwest. This opportunity will allow the project team to discuss how the Automotive program is training automotive technicians and discuss key issues in fleet best practices and methods for saving money and reducing emissions with alternative fuels and efficiency technologies.



Figure 2. Midwest Green Fleets Forum & Expo Graphic.

First Responder Workshop

The summer workshop will be held for first responders to further their understanding of alternative energy vehicles, and to build their knowledge of safety concerns and solutions when issues arise. While the workshop will officially occur during Year 2 of the grant, initial work preparing for the workshop began in Year 1. During the first year of the project, the tasks for the workshop focused on identifying and recruiting workshop participants, while also designing the workshop format and content. The workshop will take place over the course of one day and will include classroom instruction on key safety issues (i.e., electrocution, explosion potential, and fire suppression). The workshop will be comprised of handouts, presentations, and guest speakers from Clean Fuels Ohio, the Center for Automotive Research at The Ohio State University, industry partners and state agencies. Finally, the workshop will conclude with a hands-on experience with alternative fuel vehicles.

Ohio Automotive Instructor Workshop for Professional Development

The project proposal originally imagined a professional development workshop for high school faculty entitled, "The Alternative Energy Educator Workshop" to be held as an annual fall workshop to assist with understanding the emerging trends in alternative energy automotive technology education, review the Columbus State curriculum, examine recruiting tactics, learn best practices, and complete a survey of Alternative Energy Automotive education. However, CSCC will not be hosting this two-day workshop as originally planned in the project proposal. Instead, the team will take advantage of the annual Ohio Automotive Instructor Workshop held in conjunction with the National Institute for Automotive Service Excellence (ASE) and the Ohio Department of Education (ODE). This alternate workshop is a one-day event and will be held in Fall 2018. The proposed structure and topics covered at this workshop will be discussed further in Year 2.

Purchasing of Equipment

The overall purchasing of equipment was originally divided into four parts throughout the program. By November 2016, most equipment purchasing was completed leaving the project team ahead of schedule. Approximately \$70,000¹ was allocated for equipment, including: a multi-meter certification setup, automotive diagnostic scanner with certification Phase I and II, and alternative fueled vehicles. The remaining equipment purchasing involves the vehicles that will be used in the lab. This is expected to be completed during Year 2.

CSCC has a partnership with Ford, as Ford provides the program with the technology to offer their credentialing program at the college. This partnership allows instructors and students in the Automotive Lab to utilize the same technology (i.e., Ford Factory Scan tool) that Ford dealership technicians utilize to service and diagnose vehicles.



Figure 3. Supplies and equipment purchased for the alternative fuels education program.

Evaluative Question #2: How was the pool of qualified students entering the automotive program expanded? To what extent was the pool expanded by students drawn from non-traditional backgrounds?

Initial Launch of Certification Requirements

A key strategy for increasing the pool of qualified students is by increasing the number of students with industry recognized certifications. As such, the purchase of equipment and incorporation of certifications within the curriculum are critical components of the project. As previously noted, because the equipment was purchased ahead of schedule (November 2016) while modifying the curriculum, students began showing increased interest in the certification offering. As a result, the project team decided to incorporate a “soft launch” of the program beginning in January 2017 in response to student interest. This “soft launch” entails working through the curriculum and delivery method of the upcoming fully launched program (Fall 2017) to identify the optimal pedagogical approach. This initial offering began with two courses in the spring, and will continue with three additional courses in the summer.

¹ The exact total of project funds allocated for equipment purchasing during Year 1 was \$71,674.



Figure 4. Snap-on Scanner purchased for training students enrolled in program.

Various certification credential exams are being incorporated into these courses through the Snap-on/NC3 certification program at CSCC, including: Verus Edge Lab Scope Operation & Data Management Certification, Verus Edge Navigation & Scanner Operation Certification, 596 Multimeter Certification, Meter Certification Pre-test, ShopKey Pro Service & Repair Information Level 1 Certification, ShopKey Pro & SureTrack Advanced Level 2 Certification.

In year 1 of the project, two certification credential exams (i.e., Verus Edge Lab Scope Operation & Data Management Certification; Verus Edge Navigation & Scanner Operation Certification) were attempted by CSCC students (n=30 attempts by n=14 unique students). The overall passage rate for all attempted exams was 57% (n=17) with a mean score of 71% on an average of 1.4 attempts. On a student level, the passage rate regardless of number of attempts was 79% (n=11) with an average passing score of 84%. Moreover, there were six students who passed an exam on the first attempt with an average score of 87%.

Examining each of the certification credential exams individually, the passage rate for all attempts on the Verus Edge Lab Scope Operation & Data Management Certification was 60% (n=9) with a mean score of 72%. Again, on a student level, the passage rate regardless of number of attempts was 89% (n=8) with an average passing score of 86%. Further, there were 2 students who passed an exam on the first attempt with an average score of 91%. Regarding the Verus Edge Navigation & Scanner Operation Certification, the passage rate for all attempts was 53% (n=8) with a mean score of 70%. Once again, on a student level, the passage rate regardless of number of attempts was 80% (n=8) with an average passing score of 82%. Further, there were four students who passed an exam on the first attempt with an average score of 85%².

General Recruitment

The project team leveraged other departmental resources at CSCC by working with students in the Digital Design Graphics Associate Degree capstone course to conceptualize and design outreach materials.

The project developed an online “Request for Information” form hosted on the Automotive Technology section of CSCC’s website, allowing students interested in the career pathway to be contacted directly by college staff or project team members. For additional avenues of recruitment and project promotion, the project team has made progress with the local secondary education community through faculty visits to career centers, positions held by faculty on the Career Center Automotive Technology Program Advisory Board, and participation in the state SkillsUSA competition. A resulting list of email addresses of students who expressed interest or applied to the Automotive Technology program was generated to address frequently asked questions about the program or career pathway in general.

Additionally, through CSCC’s Program Spotlight series, the project team hosted a “Spotlight on Automotive” event which hosted 24 prospective students and their families. The event was simultaneously broadcasted on social media through Facebook, where the program provided a 30-minute video³ of this event available both on Facebook Live and as a post on the Columbus State Admissions Facebook page. The project team used the video to showcase the

² The certifying entity will provide national passage rates to contextualize CSCC’s passage rate as high or low.

³ The Program Spotlight Series video can be viewed at the link below:

<https://www.facebook.com/CSCCAdmissions/videos/1494081177309150/>

equipment purchased for the lab, demonstrate a lesson from the instructors, present the Ford technology utilized by instructors and students for technician training, provide an overview of career path opportunities, and offer an industry perspective on employment in the field from a Honda representative. To date, the video has been viewed 446 times.

Recruitment of Non-traditional Students

As a subset of the Automotive Program, the Alternative Energy project relies largely on the recruitment efforts of the overall department. For recruitment of underrepresented populations, the department works with other departments on CSCC's campus and related initiatives for targeted recruitment. The project is committed to recruiting underrepresented populations, including: African American minority students from the inner city, U.S. Military Veterans, and female students. Each of these populations will have a unique method of recruitment.

For recruitment of underrepresented African American minority students, the program will leverage the Diversity Program Department at CSCC, as it maintains that it is "committed to the recognition and value of the entire college community." Specific enrollment data for African Americans are not available, however, data related to minority enrollment was obtained. According to university data, during the 2014-15 academic year, 45% of CSCC's automotive technology students were minorities. For the current academic year (2016-17) the Automotive program (n=222) had 85 (38%) students identify as a racial or ethnic minority. While the percentage of minority students in the program dropped slightly, the program continues to maintain strong recruitment of minority students. Comparatively, CSCC's Automotive Technology program has a higher percentage of minority students (38%) than the percentage of minorities in the Columbus (Franklin County) area (34%; Ohio Development Services Agency, 2016).

The Veterans Affairs Office on the CSCC campus will assist with coordinating the recruitment of U.S. Military Veterans to the automotive program. Again, drawing from 2014-15 academic year data, 12% of the automotive technology students were veterans. The Automotive program had 8% (n=17) veterans during the 2016-17 academic year. Veteran enrollment is higher than the number of veterans in the Columbus area (Franklin County) at 6% (n=70,153⁴).

To recruit underrepresented female students, CSCC maintains their involvement in ODE's project "WE are STEM." The WE are STEM project is a statewide initiative to encourage female middle and high school students to consider information technology related career fields and to encourage/support their transition to college. Resulting from CSCC's participation in the WE are STEM project, an average of more than 20 high schools and 150 students have attended each event since 2006. During the 2016-17 academic year, the Automotive program had 9% (n=19) females enrolled. This percentage is on par with the national percentage of women employed in the Automotive Repair & Maintenance is 8.3% (U.S. Department of Labor, 2016).

⁴ This figure was pulled from the US Department of Veterans Affairs: https://www.va.gov/vetdata/veteran_population.asp

Recommendations

The project appears to be on track and moving forward as expected. In this first year of the project, activities have primarily centered on conducting job skills analysis using compression planning with the Industry Leadership Team, modifying existing courses, holding Industry Leadership Team meetings, designing the first responder workshop and recruiting workshop participants, and identifying high school faculty to participate in the professional development workshop. As the project moves into its second year of funding the following recommendations are provided:

- Investigate additional recruitment strategies specific to reaching underrepresented groups (i.e. African American, female, and veteran students).
- Continue to develop partnerships with local high schools to increase high school faculty and counselor awareness of the program, as well as increasing student awareness of career opportunities with the goal of creating a pipeline for the program.
- Gather feedback from prospective students on the reception of the Facebook Program Spotlight Series video. What opportunities are there to expand the viewership of the video (i.e., other CSCC social media platforms, share with local high school students, etc.)?

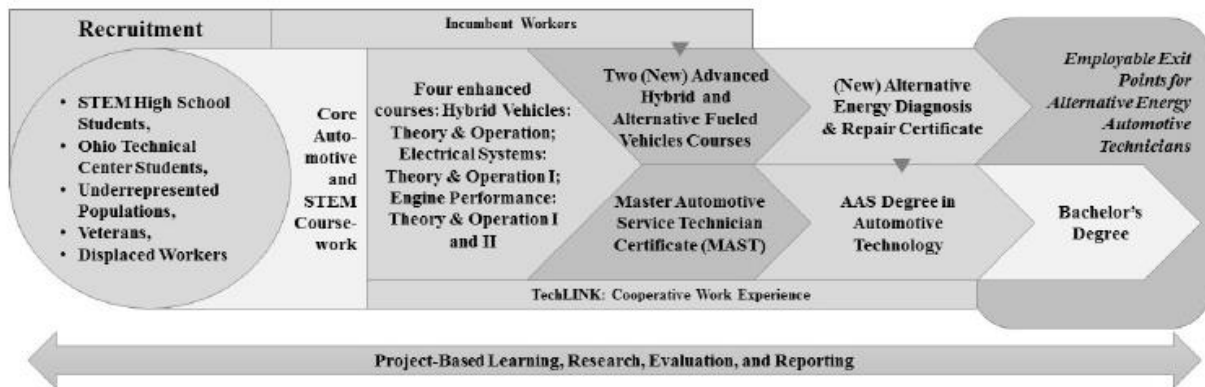
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Appendix A – Project Pathway



Appendix B – Pathways for Alternative Energy Automotive Technicians Logic Model

