Eastern West Virginia
Community and Technical College

Program Review
Certificate of Applied Science in Wind Energy Technology (C.A.S.)
2019

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CIP Code: 22150403
Eastern West Virginia Community and Technical College

Program Overview

The CAS Wind Energy Technology (WTT) program provides a technical education at the certificate degree level. Through instruction and practical application, students gain the knowledge and skills required to perform basic maintenance in modern facilities and wind turbine generation facilities. Successful completion of the CAS Wind Energy Technology program will allow graduates to enter the workforce at the entry-level technician level without extensive PLC and SCADA training. Students are prepared to apply the knowledge and skills developed in lectures and laboratories to diagnose, troubleshoot, and repair industrial machinery.

Students learn to comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

The CAS WTT curriculum prepares graduates to work in the wind industry as well as other types of manufacturing and industrial maintenance professions. Typical salaries for Wind Technicians and other industrial maintenance employees in our area range from $15 to $30 per hour; additionally, most large employers include medical and other benefits.

Both the AAS and CAS WTT programs are broad-based curricula that provide instruction and practical application of a variety of technical concepts and practices. Courses include industry-recognized maintenance practices in electrical, pneumatic, and hydraulic mechanical systems; computer control; data acquisition; and periodic/predictive maintenance program usages. The programs support the mission by addressing the expressed need for trained WTT professionals across the United States, and more importantly, many companies within Eastern's service area.

Students select classes from the following course sequence in the WTT CAS program:

First Year – Fall Semester				First Year – Spring Semester			
Dept.		**Course Title**	**Hrs.**	**Dept.**		**Course Title**	**Hrs.**
ELM	121	Fundamentals of Hydraulics and Pneumatics	4	ELM	217	Industrial Maintenance Fundamentals	3
ENL	101	English Composition I OR	3	MTH	117	Math for Technicians	4
ENL	115	Technical Communications	(3)	WTT	150	Industrial Motor Controls	4
WTT	110	Wind Safety and OSHA	4	WTT	160	Power Generation and Transmission	4
WTT	120	DC/AC Circuits	4				
Total Semester Hours			**15**	**Total Semester Hours**			**15**

Upon completion of this degree, graduates will be able to:

1. Demonstrate basic knowledge of electrical equipment and operation
2. Demonstrate basic knowledge of mechanical equipment and operation
3. Demonstrate basic knowledge of fluid power equipment and operation
4. Demonstrate safety practices common to the wind industry
5. Troubleshoot, repair, and maintain electrical systems common to wind power generation
6. Troubleshoot, repair, and maintain distribution power systems common to wind power generation

7. Troubleshoot, repair, and maintain hydraulic controls used in the wind industry
8. Use commonly available instruments to analyze and troubleshoot systems
9. Use schematics, operating manuals, and troubleshooting guides to troubleshoot equipment commonly used in the wind industry
10. Demonstrate knowledge of climbing, rescue, and emergency medical techniques and procedures necessary for the wind industry
11. Apply safety procedures in the industrial environment including those applicable to hand and power tools
12. Demonstrate job hazard assessment and resolution to hazards
13. Perform daily maintenance and repair tasks necessary in the wind industry
14. Demonstrate effective communication and computation skills

In February 2018, the Program Outcome Matrix for Wind Energy Technology was revised and the Program Learning Outcomes were reduced:

1. Demonstrate basic knowledge of electrical equipment and operations
2. Demonstrate basic knowledge of mechanical equipment and operations
3. Demonstrate basic knowledge of fluid power equipment and operations
4. Demonstrate safety practices common to the wind industry
5. Troubleshoot, repair, and maintain electrical systems common to wind power generation
6. Troubleshoot, repair, and maintain distributive power systems common to wind power generation
7. Troubleshoot, repair, and maintain hydraulic controls used in the wind industry
8. Use commonly available instruments to analyze and troubleshoot systems
9. Use schematics, operating manuals, and troubleshooting guides to troubleshoot equipment commonly used in the wind industry
10. Demonstrate climbing, rescue, and emergency medical techniques and procedures necessary for the wind industry
11. Apply safety procedures in the industrial environment including those applicable to hand and power tools
12. Demonstrate job hazard assessment and resolution to hazards

As a part of this revision, the program's courses were aligned to the Program Learning Outcomes, so that it is clear precisely which course learning outcomes support each Program Learning Outcome. This enables close monitoring of the performance of each course learning outcome (via scheduled Course Assessment Reports) which combine to demonstrate the overall performance of the Program outcome. The Course Assessment Report also incorporates a diagnostic element and action plan.to drive improvement.

The newly aligned matrix forms Appendix B. The full matrix and aligned objectives can be viewed at Share/Academics/Assessment/Programs/Wind Energy Technology/CAS.

Synopsis of Significant Findings: Meeting Learning Outcomes

Twelve Course Assessment Reports were submitted between Fall 2014 and Spring 2019. Of these, 8 (67%) showed that 75% or more of their learning outcomes had been met. Full data from submitted Course Assessment reports can be found in Appendix A.

The four reports, which showed that the benchmark had not been met, were distributed as follows:

ELM 217 – 1
ENL 101 – 1
MTH 115 – 2

ELM 217: Industrial Maintenance Fundamentals

- The next Course Assessment Report is due Spring 2019.
- Two of the learning outcomes failed to meet the 75% performance standard; however, both outcomes were no more than 5% below the benchmark.
- Although the learning outcomes for ELM 217 have changed since the last Course Assessment Report, instructors should make sure students can explain the different couplings used in industrial maintenance (missed performance standard by 15%).

ENL 101: English Composition I

- The next Course Assessment Report is due Fall 2019.
- The 2012-2015 longitudinal Course Assessment Report in ENL 101 showed that 7 learning outcomes failed to meet the 75% performance standard. However, the learning outcomes for ENL 101 have been restructured, and the most recent ENL 101 Course Assessment Report in Fall 2017 showed that all learning outcomes for the course were met above the 75% performance standard.

MTH 115: Business Math

- MTH 115 is no longer a part of the WTT AAS program. MTH 117: Math for Technicians has replaced MTH 115 and was first offered in Spring 2019. MTT should provide WTT students with the specific mathematical skills needed in their chosen field. The next Course Assessment Report in MTH 117 is due in Spring 2020.

In the absence of current Course Assessment Reports, the most recent examination of the last available results suggest that the above courses are currently functioning adequately, and immediate investigation and intervention is not needed. Writers of the next Course Assessment Reports for these courses should, as a matter of course, review previous reports and continue to address Learning Outcomes that have not been met to the 75% benchmark.

Program Improvements

The CAS WTT program was developed with the help of local wind farms industries throughout Eastern's six-county service district. The goals of the program were to educate individuals with minimal previous experience in industrial maintenance or the wind industry. The program began with a discussion of need with local and developing wind farms and progressed to develop the proper curriculum. However, after several advisory committee recommendations and the hiring of Eric Putze, Eastern's Full-time Advanced Technology/Wind Energy Instructor, several course and curriculum changes were made to expand, streamline, and better focus the program. Learning outcomes for all ELM/WTT courses were conflated to 15 outcomes or less and slightly revised for accuracy. Several program outcomes were rephrased, and a few were eliminated. Below is a summary of some of the upgrades implemented in Fall 2018:

- ENL 115: Add as an alternative to ENL 101
- MTH 115: Remove (3 semester hours)
- MTH 117: Add (4 semester hours)
- ELM 120: Increase semester hours from 3 to 4 and rename ELM 121
- WTT 101: Remove (2 semester hours)

Regional employers have been influential partners by strengthening sector partnerships and offering useful feedback at advisory committees. Industry stalwarts like Harth Clem, an Eastern graduate and former Site Supervisor at Pinnacle Wind Farms, has been instrumental in offering mock interviews and taking students on wind farm tours. Advisory committee members have also expressed concern over the level of basic writing and math skills, which has led to the implementation of co-requisite English and math courses in all advanced manufacturing programs. Eastern has also tailored both a math course (MTH 117: Math for Technicians) and English course (ENL 115: Technical Communications) for WTT and ELM students. Both MTH 117 and ENL 115 will be offered on a yearly basis beginning in 2019.

In Fall 2016, Eastern received, purchased, and installed 12 new computers for the Electromechanical and Wind Energy programs at Eastern's Technology Center. These new computers created more effective learning opportunities for students and staff. Additionally, Eric Putze has helped Eastern purchase a myriad of new machinery including new PLC and SCADA training equipment. In Spring 2018, NextEra conducted interviews with Eastern's WTT students, and future on-site job interviews are hopefully becoming a regular part of Eastern's WTT and ELM programs.

Eastern adopted Amatrol's eLearning solutions to fit the changing landscape of Eastern's technical education needs. The creation of hybrid ELM/WTT courses utilizing Blackboard's learning platform and Amatrol's comprehensive curriculum will allow for group learning flexibility. Hybrid coursework began in Fall 2017.

Identification of Weaknesses/Deficiencies

One of the weaknesses identified in Eastern's WTT programs included the lack of embedded certifications or any kind of nationally recognized exit test. Beginning in Fall 2014, as a requirement of graduation, WTT graduates were required to take the National Occupational Competency Testing Institute (NOCTI) for Wind Energy Technicians. Table 1 compares Eastern's student scores with NOCTI's post-secondary national averages:

Table 1: NOCTI Wind Technician Subscores

Student #	Safety	Equipment Operation	Electrical & Mechanical Systems	Hand Tools	Maintain Equipment	Computational, Technical, and Writing Skills	Careers in Wind Tech.	Wind Turbine Maintenance	Individual Student Average
1	86.5	100.0	69.6	89.5	90.0	81.0	100.0	90.3	**88.3**
2	75.7	100.0	67.4	47.4	53.3	66.7	80.0	54.4	**68.1**
3	83.8	100.0	93.5	84.2	83.3	90.5	100.0	88.4	**90.5**
4	75.7	100.0	50.0	47.4	80.0	66.7	80.0	65.8	**70.7**
5	78.4	100.0	76.1	57.9	90.0	81.0	80.0	78.7	**80.3**
6	67.6	100.0	69.6	42.1	66.7	71.4	80.0	67.1	**70.6**
7	64.9	100.0	47.8	57.9	63.3	42.9	80.0	57.9	**64.3**
8	73.0	100.0	76.1	68.4	66.7	90.5	80.0	75.6	**78.8**
9	56.8	50.0	52.2	42.1	63.3	81.0	80.0	58.5	**60.5**
10	78.4	100.0	60.9	57.9	83.3	85.7	80.0	73.8	**77.5**
11	89.2	100.0	73.9	79.0	70.0	87.2	100.0	78.7	**84.8**
12	75.7	83.3	58.7	26.3	56.7	57.1	60.0	59.1	**59.6**
13	56.8	83.3	52.2	52.6	46.7	52.4	100.0	54.9	**62.4**
14	75.7	83.3	67.4	63.2	80.0	85.7	80.0	74.4	**76.2**

15	70.3	100.0	65.2	52.6	66.7	76.2	80.0	68.3	**72.4**
Eastern Student Averages	**73.9**	**93.3**	**65.3**	**57.9**	**70.7**	**74.4**	**84.0**	**69.7**	**73.7**
NOCTI National Average	**74.5**	**91.7**	**68.3**	**64.9**	**74.6**	**76.9**	**86.4**	**69.6**	**75.9**

Eastern student scores are slightly below the national average, based on a small sample size, but Eastern graduates did outperform national averages in "Equipment Operation," and "Wind Turbine Maintenance."

Although NOCTI testing provided baseline assessment measures, Eastern changed its exit testing in Spring 2017 to become a mechatronics partner school with Packaging Machinery Manufacturers Institute (PMMI). PMMI certification allows students to earn industry credentials, and Eastern also began offering embedded PMMI certifications in specific courses for its students. Eastern was one of the first community colleges in West Virginia to become a mechatronics partner school with PMMI, who has reviewed, approved, and endorsed Eastern's advanced manufacturing curriculum.

AAS and CAS WTT graduates now take the PMMI Industrial Electricity 1 Certification test as a requirement before degree conferment. Table 2 shows student scores on PMMI exit testing:

Table 2: PMMI Industrial Electricity 1 Certification Scores

Stud. #	Electro-Mag.	Trans-formers	Control Relays	Elec. Circuits	Voltage/ Current	Pwr. & Circuit Protect.	Trouble shooting	Three Phase Motors	Motor Control & Prot-ection	Elect. Ladder Logic	Elect. Wiring	Contr. Comp. Trouble-shooting	Safety	Ovr. Scre
1	43%	100%	88%	86%	75%	80%	80%	67%	67%	70%	70%	100%	100%	**78**
2	29%	60%	13%	71%	50%	27%	40%	50%	0%	50%	60%	57%	60%	**44**
3	43%	40%	75%	57%	67%	47%	20%	50%	0%	40%	80%	57%	100%	**55**
4	43%	60%	63%	71%	42%	40%	40%	50%	33%	70%	50%	29%	40%	**49**
5	29%	80%	75%	100%	75%	60%	20%	67%	33%	80%	40%	43%	40%	**60**
6	29%	60%	100%	57%	75%	67%	40%	83%	67%	50%	80%	71%	100%	**68**
7	29%	80%	50%	57%	42%	53%	60%	83%	33%	60%	70%	71%	60%	**57**
8	14%	40%	38%	71%	42%	27%	20%	33%	33%	100%	70%	29%	80%	**47**
9	29%	40%	25%	43%	75%	40%	0%	33%	0%	70%	70%	14%	40%	**43**
10	14%	20%	38%	29%	50%	53%	40%	33%	67%	40%	20%	43%	40%	**38**
11	29%	80%	50%	43%	50%	27%	80%	50%	33%	20%	30%	14%	40%	**39**
12	71%	80%	63%	43%	25%	33%	20%	50%	67%	60%	50%	14%	60%	**46**
East. Stu. Avg.	**34%**	**62%**	**57%**	**61%**	**56%**	**46%**	**38%**	**54%**	**36%**	**59%**	**58%**	**45%**	**63%**	**52**

Students must score at least 70% to earn PMMI certification, which only one student has obtained at Eastern although two other students can within 10 points of earning a PMMI certificate. Hopefully, more students will gain certification in the future with curriculum adjustments. Some students resent having to take a certification test to graduate, but it is incumbent on Eastern to underline the importance of taking these PMMI tests seriously. Other Electromechanical/Wind Energy courses have embedded PMMI certifications as well, but some students lack the initiative and drive to perform well on these tests.

Future program reviews will extrapolate and analyze data based on student PMMI scores to help improve program deficiencies. Eastern will also develop guided pathway graphic organizers (i.e., Academic Maps) for its WTT programs, which allows students to easily visualize their degree pathway to career success.

Another concern with the WTT programs centers on enrollment. Enrollment has decreased from Fall 2014 through Spring 2019 as seen in Table 3:

Table 3: Five-Year Trend Data on Graduates and Majors

Semester	Headcount	FTE	Full-Time (%)	Graduates
Fall 2014	30	26.9	24 (80%)	
Spring 2015	25	22.5	19 (76%)	**2014-2015:** 14
Fall 2015	19	16.3	15 (79%)	
Spring 2016	13	14.3	12 (92%)	**2015-2016:** 8
Fall 2016	6	5.0	3 (50%)	
Spring 2017	9	7.2	5 (56%)	**2016-2017:** 3
Fall 2017	9	8.9	9 (100%)	
Spring 2018	12	10.5	9 (75%)	**2017-2018:** 4
Fall 2018	10	9.7	9 (90%)	
Spring 2019	Not Available	Not Available	Not Available	**2018-2019:** 2
TOTAL	133	121.3	105 (79%)	**Fall 2014-Spring 2019:** 31

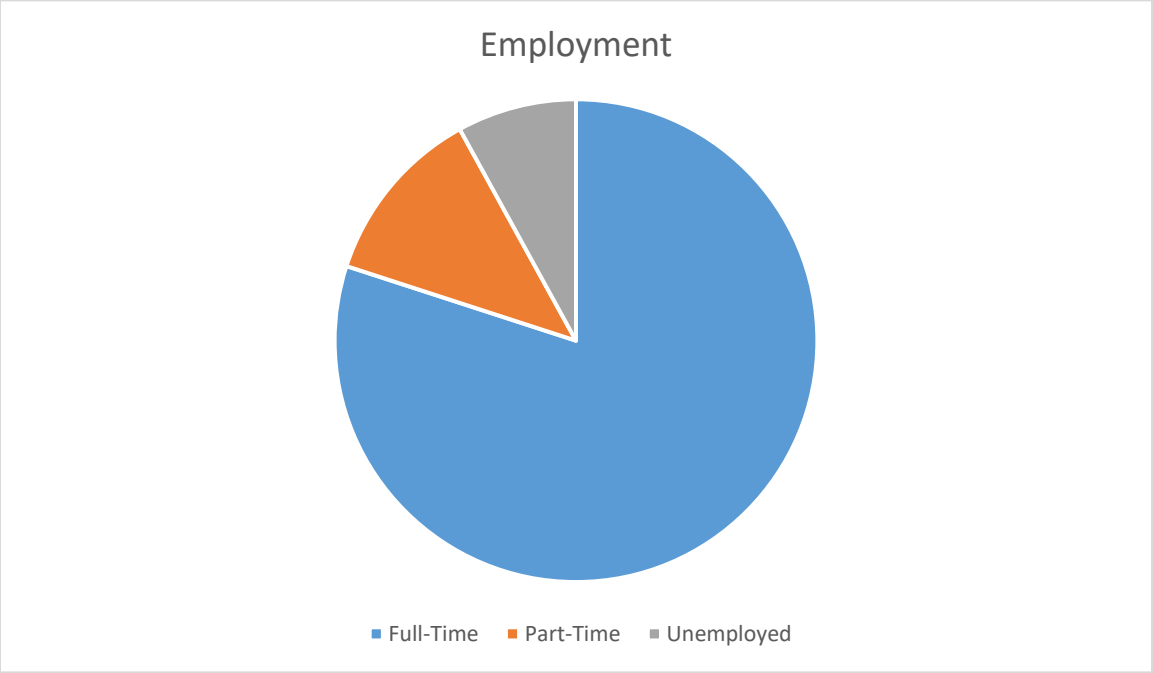
Personnel turnover was probably one of the most notable challenges for the duration of this program review, with Skip Landes retiring in Spring 2015 and Brad Goldizen resigning in August 2016, leaving Eastern with no full-time faculty member in WTT. Thus, adjuncts were recruited on short notice to keep all the WTT/ELM courses running, and as with any transition, learning pangs and minor miscommunications were experienced, which may have caused some delays in progress, but Eastern has continued to work diligently towards its goals despite these setbacks. Beginning on July 1, 2017, Eastern employed Eric Putze as the permanent, full-time Advanced Manufacturing/Wind Energy Instructor, which has added some needed stability and has helped the program to grow and develop.

Summary of Assessment Model and Utilization for Program Improvement

Eastern's assessment plan consists of three levels: entry level assessment (ACCUPLACER, SAT, ACT), active enrollment assessment (course and program assessment, student satisfaction surveys, etc.), and post-graduation assessment (employment satisfaction survey, alumni survey, employment, and salary data, etc.). Beginning in Fall 2014, WTT students participated in NOCTI, which delivers a battery of assessments for students studying career and technical programs at technical colleges in the United States but offers no industry certification. Therefore, in Spring 2017, Eastern changed its exit testing to PMMI, which offers industry-accepted certificate testing. IDEA Short Form Reports (i.e., course evaluation surveys) are administered each semester in all course sections with an enrollment of six or more students. Course completion rates and student tracking studies are used as a measure of overall program success. All courses are assessed on a cyclical basis, and recommendations for improvements are funneled into the feedback loop so that future Course Assessment Reports will address any course shortcomings. A summary of Course Assessment Reports is provided in Appendix A.

Data on Student Placement

From Fall 2014 through Spring 2019, 31 students graduated with a CAS WTT major. Of these 31 students, student placement data has been collected on 25 students (81% of cohort). No information was available on 6 graduates:



- 20 students (80%) are employed full-time
- 3 students (12%) are employed part-time
- 2 students (8%) are unemployed
- 0 students (0%) are currently enrolled in an undergraduate program
- 0 students (0%) are currently enrolled in a graduate program
- 0 students (0%) graduated with a baccalaureate degree

Final Recommendations

The recommendation is to continue offering the CAS WTT program in its current format. The following issues will be addressed during the next program review cycle:

1. By engaging adjunct faculty and full-time faculty in assessment of WTT courses, measures of student learning could be continually assessed and revised. Faculty are the key to curriculum improvement, so professional development opportunities for faculty should center on assessment training. Holding annual assessment workshops or retreats would streamline the assessment process and emphasize Eastern's commitment to closing the feedback loop. Currently, there are professional development sessions planned for course-level assessment in 2019.
2. A focus on curriculum improvements based on assessment data would help overcome classic barriers to conducting meaningful assessment. Course mapping, where program outcomes are aligned and assessed with course-level learning outcomes is a major new project that should become a part of all future program reviews. Data analysis of PMMI scores is another example of how Eastern's program-level assessment process could be improved.

3. To increase existing enrollment figures, Eastern will need a cross-discipline marketing strategy, which includes an on-going recruitment effort, utilizing the resources at hand (i.e. faculty, staff, advisory committees, recent ATT graduates), and increasing program awareness within the Potomac Highlands region. Additionally, GPS Academic Maps were created for both Wind Energy and Electromechanical degrees, which should students stay on track to graduate on time without accruing excessive college credits.

Appendix A: Summary of Course Level Assessments for All Participating Students

Semester	Course Assessed	# of Students	Outcomes Met at 75% or above	
			#	%
Fall 2014	ELM 120	14	6 of 6	100
Fall 2014	MTH 115	10	2 of 4	50
Spring 2015	ELM 217	10	2 of 5	40
Spring 2012 –Spring 2015	ENL 101	235	17 of 24	70.8
Spring 2015	WTT 160	13	4 of 4	100
Fall 2016	MTH 115	9	1 of 4	25
Spring 2017	WTT 160	4	4 of 4	100
Spring 2017	WTT 230	1	4 of 4	100
Spring 2017	WTT 260	2	3 of 3	100
Fall 2017	ENL 101	87	4 of 4	100
Fall 2017	WTT 210	3	3 of 3	100
Fall 2018	ELM 218	2	5 of 5	100

WTT CAS		Courses In Program					CORE	Gen Ed	Landmark	
		Fall Year 1					Spring Year 1			
		ELM	ENL	ENL	WTT	WTT	ELM	MTH	WTT	WTT
Program Outcomes (General Education in green)		121	101	115	110	120	217	117	150	160
CRIT	Demonstrate the ability to think critically by observing critically, reading critically, planning, reflecting, analyzing, evaluating and synthesizing by using multiple modalities of inquiry to collect information including organizing, evaluating, analyzing, and interpreting findings.									
COMM	Communicate with precision, clarity, fluency, accuracy, and coherence through their reading, writing, and verbal communications.		X				X			
MATH	Demonstrate their abilities to think mathematically by applying mathematical concepts in problem-solving including estimation, computation, analysis, assimilation, application, transference and modeling strategies as appropriate workforce skills and lifelong learning.	X				X		X		
WF/CIT	Demonstrate workforce and citizenship skills needed for professional ethical reasoning, diversity awareness, civic engagement, and steadfast participation in lifelong learning activities.									
1	Demonstrate basic knowledge of electrical equipment and operations	X			X	X	X		X	X
2	Demonstrate basic knowledge of mechanical equipment and operations	X					X			
3	Demonstrate basic knowledge of fluid power equipment and operations	X					X			
4	Demonstrate safety practices common to the wind industry	X			X		X			
5	Troubleshoot, repair, and maintain electrical systems common to wind power generation						X			X
6	Troubleshoot, repair, and maintain distributive power systems common to wind power generation									X
7	Troubleshoot, repair, and maintain hydraulic controls used in the wind industry	X								
8	Use commonly available instruments to analyze and troubleshoot systems	X				X	X			X
9	Use schematics, operating manuals, and troubleshooting guides to troubleshoot equipment commonly used in the wind industry								X	X
10	Demonstrate climbing, rescue, and emergency medical techniques and procedures necessary for the wind industry				X					
11	Apply safety procedures in the industrial environment including those applicable to hand and power tools	X			X		X			
12	Demonstrate job hazard assessment and resolution to hazards				X		X			