

**Agriculture, Food & Natural Resources Career Cluster  
Renewable Fuel Production  
Course Number: 03.46200**

**Course Description:**

This course is designed as a component of one of the pathways in the Environmental Systems Pathway. The course is designed to offer the student the opportunity to research, design, and construct processors capable of producing biofuels that can be used on the farm or ranch. It also explores possible alternatives to meeting the country's and the world's energy needs of the future. The role of agriculture in the production of renewable energy is a primary component of the class. Classroom and laboratory activities are supplemented through supervised agricultural experiences and leadership programs and activities.

**Course Standard 1**

**AFNR-RFP-1**

The following standard is included in all CTAE courses adopted for the Career Cluster/Pathways. Teachers should incorporate the elements of this standard into lesson plans during the course. The topics listed for each element of the standard may be addressed in differentiated instruction matching the content of each course. These elements may also be addressed with specific lessons from a variety of resources. This content is not to be treated as a unit or separate body of knowledge but rather integrated into class activities as applications of the concept.

**Standard: Demonstrate employability skills required by business and industry.**

The following elements should be integrated throughout the content of this course.

**1.1 Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities.**

Person-to-Person Etiquette	Telephone and Email Etiquette	Cell Phone and Internet Etiquette	Communicating At Work	Listening
Interacting with Your Boss	Telephone Conversations	Using Blogs	Improving Communication Skills	Reasons, Benefits, and Barriers
Interacting with Subordinates	Barriers to Phone conversations	Using Social Media	Effective Oral Communication	Listening Strategies
Interacting with Co-workers	Making and Returning Calls		Effective Written Communication	Ways We Filter What We Hear
Interacting with Suppliers	Making Cold Calls		Effective Nonverbal Skills	Developing a Listening Attitude
	Handling Conference Calls		Effective Word Use	Show You Are Listening
	Handling Unsolicited Calls		Giving and Receiving Feedback	Asking Questions
				Obtaining Feedback
				Getting Others to Listen

Nonverbal Communication	Written Communication	Speaking	Applications and Effective Résumés
Communicating Nonverbally	Writing Documents	Using Language Carefully	Completing a Job Application
Reading Body Language and mixed Messages	Constructive Criticism in Writing	One-on-One Conversations	Writing a Cover Letter
Matching Verbal and Nonverbal communication		Small Group Communication	Things to Include in a Résumé

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Improving Nonverbal Indicators		Large Group Communication	Selling Yourself in a Résumé
Nonverbal Feedback		Making Speeches	Terms to Use in a Résumé
Showing Confidence Nonverbally		Involving the Audience	Describing Your Job Strengths
Showing Assertiveness		Answering Questions	Organizing Your Résumé
		Visual and Media Aids	Writing an Electronic Résumé
		Errors in Presentation	Dressing Up Your Résumé

**1.2 Demonstrate creativity by asking challenging questions and applying innovative procedures and methods.**

<b>Teamwork and Problem Solving</b>	<b>Meeting Etiquette</b>
Thinking Creatively	Preparation and Participation in Meetings
Taking Risks	Conducting Two-Person or Large Group Meetings
Building Team Communication	Inviting and Introducing Speakers
	Facilitating Discussions and Closing
	Preparing Visual Aids
	Virtual Meetings

**1.3 Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations.**

<b>Problem Solving</b>	<b>Customer Service</b>	<b>The Application Process</b>	<b>Interviewing Skills</b>	<b>Finding the Right Job</b>
Transferable Job Skills	Gaining Trust and Interacting with Customers	Providing Information, Accuracy and Double Checking	Preparing for an Interview	Locating Jobs and Networking
Becoming a Problem Solver	Learning and Giving Customers What They Want	Online Application Process	Questions to Ask in an Interview	Job Shopping Online
Identifying a Problem	Keeping Customers Coming Back	Following Up After Submitting an Application	Things to Include in a Career Portfolio	Job Search Websites
Becoming a Critical Thinker	Seeing the Customer's Point	Effective Résumés:	Traits Employers are Seeking	Participation in Job Fairs
Managing	Selling Yourself and the Company	Matching Your Talents to a Job	Considerations Before Taking a Job	Searching the Classified Ads
	Handling Customer Complaints	When a Résumé Should be Used		Using Employment Agencies
	Strategies for Customer Service			Landing an Internship
				Staying Motivated to Search

**1.4 Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity.**

<b>Workplace Ethics</b>	<b>Personal Characteristics</b>	<b>Employer Expectations</b>	<b>Business Etiquette</b>	<b>Communicating at Work</b>
Demonstrating Good Work Ethic	Demonstrating a Good Attitude	Behaviors Employers Expect	Language and Behavior	Handling Anger
Behaving Appropriately	Gaining and Showing Respect	Objectionable Behaviors	Keeping Information Confidential	Dealing with Difficult Coworkers
Maintaining Honesty	Demonstrating Responsibility	Establishing Credibility	Avoiding Gossip	Dealing with a Difficult Boss
Playing Fair	Showing Dependability	Demonstrating Your Skills	Appropriate Work Email	Dealing with Difficult Customers

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Using Ethical Language	Being Courteous	Building Work Relationships	Cell Phone Etiquette	Dealing with Conflict
Showing Responsibility	Gaining Coworkers' Trust		Appropriate Work Texting	
Reducing Harassment	Persevering		Understanding Copyright	
Respecting Diversity	Handling Criticism		Social Networking	
Making Truthfulness a Habit	Showing Professionalism			
Leaving a Job Ethically				

### 1.5 Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills.

Expected Work Traits	Teamwork	Time Management
Demonstrating Responsibility	Teamwork Skills	Managing Time
Dealing with Information Overload	Reasons Companies Use Teams	Putting First Things First
Transferable Job Skills	Decisions Teams Make	Juggling Many Priorities
Managing Change	Team Responsibilities	Overcoming Procrastination
Adopting a New Technology	Problems That Affect Teams	Organizing Workspace and Tasks
	Expressing Yourself on a Team	Staying Organized
	Giving and Receiving Constructive Criticism	Finding More Time
		Managing Projects
		Prioritizing Personal and Work Life

### 1.6 Present a professional image through appearance, behavior and language.

On-the-Job Etiquette	Person-to-Person Etiquette	Communication Etiquette	Presenting Yourself
Using Professional Manners	Meeting Business Acquaintances	Creating a Good Impression	Looking Professional
Introducing People	Meeting People for the First Time	Keeping Phone Calls Professional	Dressing for Success
Appropriate Dress	Showing Politeness	Proper Use of Work Email	Showing a Professional Attitude
Business Meal Functions		Proper Use of Cell Phone	Using Good Posture
Behavior at Work Parties		Proper Use in Texting	Presenting Yourself to Associates
Behavior at Conventions			Accepting Criticism
International Etiquette			Demonstrating Leadership
Cross-Cultural Etiquette			
Working in a Cubicle			

### Support of CTAE Foundation Course Standards and Georgia Standards of Excellence L9-10RST 1-10 and L9-10WHST 1-10:

Georgia Standards of Excellence ELA/Literacy standards have been written specifically for technical subjects and have been adopted as part of the official standards for all CTAE courses.

## Course Standard 2

### AFNR-RFP-2

#### Relate the role of the FFA in his/her personal development.

- 2.1 Illustrate the relationship of the FFA within the Agricultural Education model and describe the role and function of the organizational structure from the chapter to national level.
- 2.2 Demonstrate communication skills individually and within group situations by using public speaking skills and parliamentary procedure abilities.
- 2.3 Design personal leadership plan that includes opportunities for personal development through student, chapter, and community related activities.

## Course Standard 3

### AFNR-RFP-3

#### Explore, develop, and implement Supervised Agricultural Experience (SAE) program by exploring careers in agriculture and agribusiness.

- 3.1 Design, implement, and document SAE by recording steps, skills acquired, and financial information.
- 3.2 Demonstrate employability skills such as work ethic, timeliness, communication, and self-direction.
- 3.3 Explain the role of the different types of agribusiness in society and identify agribusinesses in the local community.
- 3.4 Define agribusiness terminology and discuss the role of marketing in agricultural production.
- 3.5 Analyze skills, education requirements, income, and advantages and disadvantages of careers in the agriculture industry.

## Course Standard 4

### AFNR-RFP-4

#### Research, plan, construct, and use a bio-diesel processor to produce bio-diesel fuel capable of passing ASTM (American Society for Testing and Materials) standards.

- 4.1 Research Rudolf Diesel to determine the process he used in the development of the diesel engine with special emphasis on the fuels that he considered to be used in his engine.
- 4.2 Research the history of bio-diesel production to determine its purpose and possible uses.
- 4.3 Compare and contrast an engine and a motor.
- 4.4 Compare and contrast a diesel engine and a gasoline engine.
- 4.5 Compare and contrast a two-stroke- and a four-stroke-engine.
- 4.6 Define transesterification and explain how it is used in bio-diesel processing.
- 4.7 Develop a flow-chart describing the bio-diesel production process including the chemical reactions in the process.
- 4.8 Determine what by-products are produced in the bio-diesel production process and possible use or containment could be implemented.
- 4.9 Examine the dangers in the bio-diesel production process and develop and implement a safety protocol for the process.
- 4.10 Develop procedures used to produce bio-diesel.

## Course Standard 5

### AFNR-RFP-5

**Research, plan, construct, and use an ethanol processor to produce ethanol fuel that can be used in an internal combustion engine.**

- 5.1 Research ethanol and be able to list its etymology, chemical formula, history, properties, and uses.
- 5.2 Research the process of ethanol production and develop a set of procedures that would produce repeatable and consistent results.
- 5.3 Determine what substances can be used to produce ethanol.
- 5.4 Build an ethanol processor.
- 5.5 Research internal combustion engine and be able to explain how it works.
- 5.6 Produce some ethanol that can be used as a fuel in an internal combustion engine.
- 5.7 Examine the dangers in the ethanol production process and develop and implement a safety protocol for the process.

## Course Standard 6

### AFNR-RFP-6

**Research, plan, and construct an anaerobic digester to produce methane gas that can be used to heat an enclosed space.**

- 6.1 Research methane and be able to list its etymology, chemical formula, history, properties, and uses.
- 6.2 Define anaerobic.
- 6.3 Determine what substances can be used in an anaerobic digester to produce methane.
- 6.4 Build an anaerobic digester.
- 6.5 Develop a set of procedures that would produce repeatable and consistent results in the production of methane.
- 6.6 Demonstrate how to capture the methane gas produced by the anaerobic digester and use as a fuel for a furnace or heater.
- 6.7 Examine the dangers in the methane production process and develop and implement a safety protocol for the process.

## Course Standard 7

### AFNR-RFP-7

**Research, plan, construct, and use an algae growth chamber that can be used to grow algae capable of being used for bio-diesel production.**

- 7.1 Research algae and be able to list its etymology, classification, relationship to higher plants, morphology, physiology, symbiotic algae, life-cycle, numbers, distribution, locations, and uses.
- 7.2 Determine which species of algae would be best for producing oil that can be used in the bio-diesel process.
- 7.3 Determine what environmental factors need to be developed to reach optimum growth of the algae.
- 7.4 Determine what collection methods would be needed to harvest the oil from the algae.
- 7.5 Construct an algae growth chamber and grow some algae.

## Course Standard 8

### AFNR-RFP-8

#### **Research, plan, construct, and use a fuel cell to power a model car.**

- 8.1 Research fuel cells and be able to list and discuss its history and types of fuel cells and design.
- 8.2 Build a fuel cell that can be used to power a toy car.
- 8.3 Extrapolate the results of the fuel cell demonstration model to determine practical uses of a fuel cell in the real world.