



ENVI F150: Introduction to Biomass Energy Systems

1 Credit

Spring 2021

General Information

<i>Instructor:</i>	Eric S. Goddard	<i>Office Location:</i>	Passive Office, Bristol Bay Campus
<i>Email:</i>	esgoddard01@alaska.edu	<i>Office Hours:</i>	By appointment
<i>Telephone:</i>	907-843-2233	<i>*Course Type:</i>	Lecture
<i>**Course Location:</i>	Hybrid: BlackBoard/Zoom Links Pending	<i>Meeting Time:</i>	Tuesdays, Feb. 2 – March 2; 5:00 – 8:20PM

Prerequisites

There are no prerequisites required for this course.

Course description

Biomass is a rapidly growing portion of the sustainable energy sector. Innovation meets historic and contemporary organic fuel types such as wood, agricultural, waste, and algae. Various technologies and fuel types are covered that contribute to practical biomass energy today, with a focus on wood thermal energy in Alaska.

In-depth Course description

Biomass energy is the oldest form of energy utilized intentionally by man. From the wood cooking and heating fires of our ancestors to the experimental algae bioreactors of today, organic lifeforms store thermal energy that can be harnessed for use. Biofuel also is considered the most “carbon neutral” of the combustible fuel types due to atmospheric carbon storage and sequestration functions by the lifeforms utilized. Various trees, lignocellulosic plants, algae, organic waste products and manures are particularly useful in this process and modern technology is striving to make the most efficient use of them. Biomass systems can produce heat, electricity, or both combined. Expanding biomass fuel use can greatly offset the need for fossil fuels with a “greener and cleaner” renewable resource that also can be a more affordable option. Another substantial quality of biomass energy is the inherent capacity to create regional employment and keep the fuel economy local.

This course will take a quick trip through biofuel history, the various types of biofuels available today, differences between 1st/2nd/3rd generation biofuels, various strategies

employed in Alaska for transforming waste products into fuel, and practical biofuel usage in Alaska. Many systems have been deployed throughout Alaska utilizing the regions natural resources, demographics, and geographic peculiarities to their advantage. Students will gain practical knowledge and a deeper understanding of biomass to better discuss the various roles it can play as a modern energy source and the basics of evaluating a project in their community.

Representative Course Readings/Materials

All materials will be provided by the instructor in either electronic or hardcopy format.

Course Texts:

1. Becker, D., Lowell, E., Bihn, D., Anderson, R.; Taff, S. (2014) Community Biomass Handbook. Volume I: Thermal Wood Energy. United States Department of Agriculture. Forest Service. Pacific Northwest Research Station. PNW-GTR-899.
 - a. <https://www.fs.usda.gov/treearch/pubs/45769>
2. Lowell, E., Parrent, D., Deering, R., Bihn, D., Becker, D. (2015) Community Biomass Handbook Volume 2: Alaska, Where Woody Biomass Can Work. United States Department of Agriculture. Forest Service. Pacific Northwest Research Station. General Technical Report PNW-GTR-920
 - a. <https://www.fs.usda.gov/treearch/pubs/49700>

Supplemental Course Readings/Materials

Primary and Secondary Literature Articles

1. **Lee, R. A., and Lavoie, J. M. (2013) From first- to third-generation biofuels: Challenges of producing a commodity from a biomass of increasing complexity.** Université de Sherbrooke, Quebec, Canada. *Animal Frontiers* 3(2):6-11
 - a. https://www.researchgate.net/publication/273492026_From_First-to-Third-Generation_Biofuels_Challenges_of_Producing_a_Commodity_from_a_Biomass_of_Increasing_Complexity. DOI: [10.2527/af.2013-0010](https://doi.org/10.2527/af.2013-0010)
2. **National Energy Education Development Project (2019).** Secondary Energy Infobook. www.NEED.org.



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- a. <https://www.need.org/wp-content/uploads/2019/10/Secondary-Energy-Infobook.pdf>

3. Other relevant literature and resources provided as needed and subject to change. All web links, photo rights, and literature otherwise are cited or referenced on corresponding lecture slides.

Technology requirements

Zoom and **Blackboard** will be required. They are both free software. Zoom is open source and your Blackboard account is provided through UAF.

Zoom is an open source conferencing application and should be downloaded and accessed prior to beginning your first session. This will speed up any connection issues and identify compatibility issues prior to the first session. (<https://www.alaska.edu/virtual-campus/zoom/>)

Blackboard (BB) allows for conferencing as well through BB Collaborate Ultra, but also has many other features. This is the location that the syllabus, class announcements, reading, homework, discussion, grades and other important information will be located. This is the standard ECampus platform used for delivering classes at UAF. It is the student's responsibility to access and familiarize yourself with this platform prior to beginning class. Students will use their UAF login credentials and UAF email (created once you become enrolled in any UAF class) to access BB. UAF, OIT (<https://www.alaska.edu/oit/get-help/>) is available to help with any issues you may have. Also, you may contact me by appointment prior if you are having any issues or need help familiarizing yourself with BB.

Google Drive

May be necessary, in which case Assignments would be submitted by email to the instructor (esgoddard01@alaska.edu) and then uploaded to Google Drive for final review. The instructor will share relevant Google Drives with students and control permissions and access to folders. Please review the [academic integrity](#) section of this syllabus regarding items submitted to Google Drive. Reading assignments and other materials may also be accessed through this format as necessary.



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Phone Access and Conferencing will be necessary in the event that Zoom or Blackboard utilize too much bandwidth or data requirements to make them feasible for your learning experience. The phone conference number and dial in are as follows:

- **Toll-free dial-in number (U.S. and Canada):**
 - (866) 832-7806
- **Participant conference code:**
 - 1844818

Course Goals

The goals of this course are to provide students with a foundation of practical skills and knowledge concerning biomass as an energy source. Upon course completion, students should be able to explain various forms of biomass in depth and the ecological and/or socio-economic benefits.

Student Learning Outcomes and Objectives

Upon completion of this course, students should be able to:

1. Explain the historic, present and future uses of biomass;
2. Discuss the characteristics and advantages/disadvantages of different biomass system types;
3. Describe biomass potential as it relates to heat production, electrical energy, and the carbon cycle;
4. Describe the common fuel types used in biomass systems;
5. Speak to biomass development in Alaska for rural and urban communities;
6. Calculate: Simple payback and cost analysis, heat/energy requirements, and fossil fuel offset for a location utilizing biomass energy.

Instructional Methods

This course will primarily be an intensive one-week workshop including lectures, discussions, hands-on software activities and other technologies-based software or applications and may include homework and additional reading.

The primary instructional method will be lecture through distance delivery methods or face-to-face if COVID-19 restrictions allow (see [COVID-19](#)). In person classes may also be simultaneously broadcast to other students at various locations to integrate learning



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methods. Classes also will include small group projects and discussions. Reading assignments will require comprehension and ability to write review papers for credit. Be prepared for pop quizzes based on lectures, reading, guest speakers, video media or any other form of teaching presentation.

Explanation of Student Effort

"A credit hour is an amount of work represented in intended learning outcomes and verified by evidence of student achievement that is an institutionally established equivalency that reasonably approximates not less than: 1) one hour of classroom or direct faculty instruction and a minimum of two hours of out-of-class student work each week for approximately fifteen weeks for one semester, or 2) at least an equivalent amount of work for other academic activities as established by the institute, including laboratory work, internships, practica, studio work, and other academic work leading to the award of credit hours." (<https://www.uaf.edu/uafgov/faculty-senate/curriculum/Academic%20Course%20and%20Degree%20Procedures%20Manual%202020.pdf>)

Ergo, each credit hour of class taken by UAF standard is equivalent to 40 hours of learning time wherein, 13.3 is mandatory time with the instructor. Therefore, students have an expected commitment of two hours of personal effort toward studying and assignments, for every hour of instruction time $[40\text{hrs}/3 = 13.3\text{hrs instructional time} + (13.3\text{hrs} * 2) = 26.6\text{hrs additional student time}$. $26.6\text{hrs additional student time} + 13.3\text{hrs instructional time} = 40\text{ hrs learning time anticipated total per credit hour}$). This university guideline indicates that a student should be prepared to commit 26.6 hours of time to homework and studies for a one credit hour class. By this standard, a 2 credit hour class would have 26.6 hours of instructional time and the student would be prepared to commit no more (or less) than 53.3 hours to homework and additional studies. Apply this rule to any additional credits.

Class notes and activities cover all necessary materials outside of any assigned reading. Students should attend class and take notes regularly to achieve optimal success.

Course Calendar

Sections	Discussion Topics and Assignments	Assignments	Student Learning Objectives
1	Introduction and syllabus review		Students will be introduced to course objectives and each other.
2	History of Biomass	Homework/Quiz 1	Students will take a brief trip through the History of Biomass.
3	Types of Biomass Energy	Homework/Quiz 2	Students will learn a comprehensive review of biomass energy types.
4	Thermal Wood Energy Biomass Systems: Making the Case	Homework/Quiz 3	The fundamentals and practical needs for thermal energy produced from wood will be explored.
5	Thermal Wood Energy: Systems and Logistics		Various wood energy systems and the logistics behind them will be addressed.
6	Thermal Wood Energy: Technology	Homework/Quiz 4	A more in depth view of the thermal wood energy system technologies.
7	Thermal Wood Energy: Economics	Class economic exercises: 1-5	The economics of assessing the installation needs of a Wood Biomass System are analyzed.
8	Thermal Wood Energy: Project Management	Wood Energy Financial Calculator	The fundamental challenges of installing a Wood Biomass system in your community will be explained in further detail.
9	Thermal Wood Energy: Case Studies		Case studies of current wood energy biomass systems in Alaska will be explored for practical purposes.
10	Final Exam	Final Exam	A comprehensive test of knowledge obtained from class section objectives.



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Evaluation and Grading (TBD)

This class is graded on a Pass-Fail scale. Grading will be based upon a percentage of the total points earned for quizzes, homework and attendance. You must achieve a score of 70% or better to pass. Your grade will be determined as follows:

Attendance and participation.....20%

- Students are expected to attend all class sessions, take notes and actively participate in group discussions.

Class exercises and review.....40%

- Homework and quizzes assigned as needed.

Final Exam.....40%

Course Policies

1.) Classroom Rules

- Students are expected to comply with the UAF Student Code of Conduct: <https://uaf.edu/deanofstudents/student-code-of-conduct/>
- Cellphones are to be turned off and put away. Do not take them out during class unless asked for instructional purposes or emergency
- Be on time. Late entrances disrupt others.
- Please respect the rights of others to learn. Behaviors that distract attention from lecture or class activities will not be tolerated. Conduct that unreasonably interferes with the learning environment or that violates the rights of others is prohibited by the standards and guidelines collectively described as the UA Student Code of Conduct.
- Do not share the course link(s) with anyone outside of the class.
- If this course is in a virtual meeting format, please do not allow unnecessary distractions from home residents, pets, etc. during sessions.

2.) Attendance, Tardiness, Class Participation, Make-up Exams

Regular attendance is necessary for success at the collegiate level. You are expected to actively participate in all classroom sessions. Make sure that you are prompt and that you stay for the scheduled class time. Experience has shown that due to the time constraints of this course your grade will be jeopardized if you are absent from

class. Excessive tardiness or absence will not be tolerated and will reflect accordingly on your final grade.

3.) Plagiarism And Academic Integrity

Academic dishonesty applies to examinations, assignments, laboratory reports, fieldwork, practicums, creative projects, or other academic activities. Examples include, but are not limited to:

- a) presenting as their own the ideas or works of others without proper citation of sources;
- b) utilizing devices not authorized by the faculty member;
- c) using sources (including but not limited to text, images, computer code, and audio/video files) not authorized by the faculty member;
- d) providing assistance without the faculty member's permission to another student, or receiving assistance not authorized by the faculty member from anyone (with or without their knowledge);
- e) submitting work done for academic credit in previous classes, without the knowledge and advance permission of the current faculty member;
- f) acting as a substitute or utilizing a substitute;
- g) deceiving faculty members or other representatives of the university to affect a grade or to gain admission to a program or course;
- h) fabricating or misrepresenting data;
- i) possessing, buying, selling, obtaining, or using a copy of any material intended to be used as an instrument of assessment in advance of its administration;
- j) altering grade records of their own or another student's work;
- k) offering a monetary payment or other remuneration in exchange for a grade; or
- l) violating the ethical guidelines or professional standards of a given program.

For more, see [Students Rights and Responsibilities](#).

4.) Extended Absence Policy

Extended absences are defined as missed classes or course work by students beyond what is permissible by the instructor's written course policies. Students may need to miss class and/or course work for a variety of reasons, including, but not limited to:

- bereavement
- personal illness or injury
- serious illness of a friend, family member or loved one



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- military obligations
- jury service
- other emergency or obligatory situations

For more information, go to the student handbook or the Center for Students Rights and Responsibilities.

5.) UAF Incomplete Grade Policy:

Your instructor follows the University of Alaska Fairbanks Incomplete Grade Policy:

"The letter "I" (Incomplete) is a temporary grade used to indicate that the student has satisfactorily completed (C- or better) the majority of work in a course but for personal reasons beyond the student's control, such as sickness, has not been able to complete the course during the regular semester.

Negligence or indifference are not acceptable reasons for an "I" grade."

For more information, see [the UAF regulations regarding grades](#).

Student Protections Statement

I will work with the Office of Disability Services to provide reasonable accommodation to students with disabilities. The Office of Disability Services implements the Americans with Disabilities Act (ADA), and ensures that UAF students have equal access to the campus and course materials. I will work with the Office of Disabilities Services (208 Whitaker, 907-474-5655) to provide reasonable accommodation to students with disabilities uaf.edu/disability/

UAF embraces and grows a culture of respect, diversity, inclusion, and caring. Students at this university are protected against sexual harassment and discrimination (Title IX).

Faculty members are designated as responsible employees, which means they are required to report sexual misconduct. Graduate teaching assistants do not share the same reporting obligations. For more information on your rights as a student and the resources available to you to resolve problems, please go to the following site:

<https://www.uaf.edu/handbook/>

Title IX

University of Alaska Board of Regents have clearly stated in BOR Policy that discrimination, harassment and violence will not be tolerated on any campus of the University of Alaska. If



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you believe you are experiencing discrimination or any form of harassment including sexual harassment/misconduct/assault, you are encouraged to report that behavior. If you report to a faculty member or any university employee, they must notify the UAF Title IX Coordinator about the basic facts of the incident.

Your choices for reporting include:

- 1) You may access confidential counseling by contacting the UAF Health & Counseling Center at 907-474-7043;
- 2) You may access support and file a Title IX report by contacting the UAF Title IX Coordinator at 907-474-6600;
- 3) You may file a criminal complaint by contacting the University Police Department at 907-474-7721. <https://uaf.edu/oeo/civil-rights/aa-eo/>

Any UAF employee or volunteer who reasonably suspects or observes minor abuse or maltreatment is required to report the incident. Reporting procedures are available on the UAF Protection of Minors. Violation of this policy by employees shall be reported as well.

Equal Opportunity Employer

UA is an AA/EO employer and educational institution and prohibits illegal discrimination against any individual: alaska.edu/nondiscrimination.

Library

Contact the Elmer E. Rasmuson Library at UAF reference desk for help with research. library.uaf.edu or 907-474-7481

Student Support Services

The Student Support Services (SSS) program, located in 514 Gruening Building, provides opportunities for academic development, assists students with college requirements, and serves to motivate students towards successful completion of their degree program.

Students have access to services if they meet any of the three eligibility requirements: a) limited income, b) documented disability, or c) first generation college student. Students receive intensive advising, one-one-one tutoring, technology check-outs, free printing and copying, computer lab space, and many other services. Additional information is at <https://www.uaf.edu/ssc>, or contact them directly at (907) 474-6844.



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Rural Student Services

Responding to student needs by providing quality services to Native and rural students who expend positive effort in the pursuit of higher education and its opportunities. Please see: <https://uaf.edu/ruralss/>. Additional student support services can be found here: <https://www.uaf.edu/ruralss/tutoring-services/>.

UAF Help Desk

Go to <https://alaska.edu/oit/> to see about current network outages and news. Reach the Help Desk at: helpdesk@alaska.edu or 907-450-8300 (in the Fairbanks area) or 1-800-478-8226 (outside of Fairbanks).

Effective Communication Resources

- UAF Speaking Center (907-474-5470, speak@uaf.edu, Gruening 507)
- Writing Center (907-474-5314, uaf-writingcenter@alaska.edu, Gruening 8th floor)
- UAF Math Services, uafmathstatlab@gmail.com, Chapman 305 (for math fee paying students only)
- Debbie Moses Learning Center at CTC (907-455-2860, 604 Barnette St, Room 120).
- Developmental Math Lab, Gruening Building, Rm 406

For more information and resources, please see the academic advising resource list: https://www.uaf.edu/advising/lr/SKM_364e19011717281.pdf

Veteran and Military Support Services

UAF is committed to all veterans and military students—active duty, reserve, guard, separated and retired—as well as their dependents who are exploring UAF's academic opportunities. Staff members in Financial Aid, Admissions, Career Services, Veterans' Services and the Veterans' Resource Center are here to help you with any challenges you encounter while working while in or transitioning from a military to an academic environment. Please contact the Veterans Resources Center, 907-474-2475, <https://uaf.edu/veterans/> in room 111 in the Eielson Building.



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Emergency Notification Plan

Students will receive emergency notifications via phone or email. Please check your uafonline account to confirm your emergency notification settings. For more information, please refer to the student handbook. In cases where you do not have access to your devices, as your instructor, I will take responsibility to relay any emergency notifications.

COVID-19, Addition and Policy

Students should keep up-to-date on the university's policies, practices, and mandates related to COVID-19 by regularly checking this website:

<https://sites.google.com/alaska.edu/coronavirus/uaf/uaf-students?authuser=0>

Further, students are expected to adhere to the university's policies, practices, and mandates and are subject to disciplinary actions if they do not comply.