

Biofuel Vehicle Project

Fall 2013
ENGR333a
Calvin College
Prof. Heun

Many schools and other organizations operate vehicles powered by biofuels. Biofuels such as bioethanol and biodiesel are produced using biomass, vegetable oils, and animal fats. Your question for this semester is:

What would it take for Calvin College to operate a biofuel vehicle from campus resources?

To answer the primary question, you will find the need to explore several additional questions, including, but not limited to:

- What biofuel feedstocks are available on campus?
- How will the feedstock be harvested, transported, and converted to biofuel?
- What biofuel vehicle should be purchased?
- What jobs should the biofuel vehicle perform on (or off) campus?
- How could a biofuel vehicle be integrated into existing campus infrastructure?
- What facilities would be required to operate a biofuel vehicle on campus?
- On what criteria will you assess vehicle and fuel options?
- What would it cost to own and operate the biofuel vehicle?
- How will you communicate the presence and virtues of a biofuel vehicle to various Calvin College constituents? (This question is to be pursued primarily by a section of BUS380.)

Your response to the main question (“*What would it take ...*”) should take the form of a single report containing comprehensive and accurate information on the biofuel vehicle, fuel processing, and supporting infrastructure that could be used to move ahead with biofuel vehicle plans if a decision were made to pursue this project. Your report should be thorough enough for the ultimate decision-maker on campus (President LeRoy) to make a decision whether to purchase and operate a biofuel vehicle.

Your deliverables are:

- (a) a final report that provides a detailed description of your work during the semester and a recommendation to the decision-maker whether we should procure a biofuel vehicle and develop supporting infrastructure,
- (b) two posters to be presented at the Calvin Environmental Assessment Program (CEAP) conference at 3:30 PM on Thursday 5 December 2013 (venue TBD)
- (c) an Engineering department seminar on Monday 9 December 2013 (venue TBD)

Each student must attend either (a) the CEAP Poster Session or (b) the Engineering Seminar.

Your final report will consist of:

- (a) paper copies of your final technical memo with extensive appendices (the tech memo must be a single report for the entire class),
- (b) an electronic copy of your final report (.pdf format, one single file) to be posted at <http://www.calvin.edu/~mkh2>, and

- (c) a CD or DVD containing electronic copies of all posters, presentations, programs, and analysis tools that you developed during the project.

The customer for your final report is Physical Plant director Phil Beezhold. The final written report should follow the technical memo format, including a two-page summary with conclusions followed by extensive appendices. Each group (see below) must provide one detailed appendix (in technical memo format, of course) to the overall technical memo that describes the analyses performed by and the contributions from each group.

You must distribute copies of your final report (all three elements) to your ultimate customer, your supporting resources (see below), and your professor. The final report is due on **Monday, 16 December 2013 at Noon**. As a class, you must also send a note of appreciation to each resource for their assistance during the semester.

Prior to the first class meeting each week (typically Monday), each student must submit a weekly timecard that includes

- hours worked on the project
- brief (1 paragraph) description of work accomplished.

You will pursue this project in small groups of approximately 4 students each. Initially, the groups will be organized as follows:

- Feedstock
- Fuel production
- Vehicle
- Infrastructure/Facilities

As a class, you may find it necessary to adjust the topics being addressed by each group, redistribute the workforce among the groups, or develop new groups altogether as the semester progresses. You may simply make the change yourselves provided that you inform the professor and supply justification.

You should consider forming an executive council consisting of representatives from each of the groups above. The executive council could be responsible for coordinating all activities among the groups, planning the final report, and writing the introductory two pages of the report, among other things.

The professor will select students to fill the groups. To apply for one of the available groups, prepare a cover letter and resume and deliver it to your professor on **Friday, 6 September 2013** before lecture. Your cover letter should indicate the group in which you are interested and why you are qualified for that position. Group assignments will be announced via Moodle in the evening of **Saturday, 7 September 2013**.

An initial task for each group is to develop a schedule of your activities for the semester that coordinates with the schedules of other groups. The schedule must show milestones corresponding to points of interaction with other groups. Schedules must be presented during the first oral progress reports (see below).

There will be three short, in-class progress reports in the form of oral presentations. There will be a longer in-class final presentation that summarizes the results of the project. Each student must give either (a) a progress report presentation or (b) part of the final presentation. The presentations must be professional quality, must concisely report your progress, and must provide sufficient technical detail for

customer, professor, and peer review of your progress. Please have only 1 student participating in oral progress report and 2 students (at most) participating in the final in-class report.

The in-class progress reports must follow the following outline:

- Status relative to your schedule (and any re-planning that has occurred since your last report)
- Work accomplished since your last report (including technical and cost details)
- Issues or concerns (and plan for addressing them)
- Work planned for upcoming reporting period

The final in-class oral report need not follow the outline above. Rather it should summarize the final technical details of your work, how your work was used in the final conclusions, and the conclusions for your group.

You must bring printed copies (6-up, double sided to save paper) of all in-class presentations for guests and the professor.

Although the customer for this report is Phil Beezhold, your professor will assign final grades (in consultation with the resources for the project). Students will be assessed on (a) the quality of their team's contribution to the overall effort of the class and (b) peer evaluation. The professor, in conjunction with our external resource persons, will select an exemplary student for a teamwork award at the end of the semester.

Supporting Resources:

- Phil Beezhold, Director of Physical Plant: the customer
(616) 526-6481, pdb2@calvin.edu
- David LaGrand: biofuel producer and consumer, local politician
(616) 540-0994 (mobile), davidlagrand@hotmail.com
- Geoff Van Berkel: physical plant
(616) 526-6847, gvberkel@calvin.edu
- Previous ENGR333 design projects available from
http://www.calvin.edu/~mkh2/thermal-fluid_systems_desig/
- Classroom learning on exergy, energy, economics, and thermal analysis
- Prior laboratory and lecture classes
- Independent research

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Full-class project meetings are held in NH050.

Note: bold schedule items will include participation of the customer and resource persons.

Day	Date	Activity
Thur	5 Sep	Project introduction, objectives, deliverables, intro. to resources (Combined meeting with BUS380 at 10:30 in SB110.)
Fri	6 Sep	Cover letters and resumes due to Prof. Heun at class. Groups assigned next day.
Thur	12 Sep	Project work day (Meet in the classroom for group work)
Thur	19 Sep	In-class group presentations (7 minutes + 2 for questions) Use required outline. (Not meeting with BUS380. Meet at 10:30.)
Thur	26 Sep	Project work day (Meet in the classroom for group work)
Thur	3 Oct	In-class group presentations (7 minutes + 2 for questions) Use required outline. (Not meeting with BUS380. Meet at 10:30.)
Thur	10 Oct	Project work day (Meet in the classroom for group work)
Thur	17 Oct	Project work day (Meet in the classroom for group work)
Thur	24 Oct	Project work day (Academic Advising)
Thur	31 Oct	In-class group presentations (7 minutes + 2 for questions) Use required outline. (Combined meeting with BUS380. Meet at 10:00 in SB110.)
Thur	7 Nov	Project work day (Meet in the classroom for group work)
Thur	14 Nov	Project work day (Meet in the classroom for group work)
Fri	15 Nov	Project work day (Meet in the classroom for group work)
Mon	18 Nov	Project work day (Meet in the classroom for group work)
Wed	20 Nov	Project work day (Meet in the classroom for group work)
Thur	21 Nov	Project final presentations (15 minutes + 5 for questions) Report on final results. (Combined meeting with BUS380. Meet at 10:00 in SB110.)
Thur	5 Dec	BUS380 Final Presentations. All ENGR333 students required to attend. (Meet at 10:00 in SB110.)
Thur	5 Dec	CEAP Poster Session, 3:30 PM (Location TBD)
Mon	9 Dec	ENGR Department Seminar 3:30 PM (Location TBD)
Mon	16 Dec	Final report due at Noon