

Calvin College Carbon Neutrality Design Project

Fall 2007

BIOL354b and ENGR333a

Professors Warners and Heun

The May 2007 report by the UN's Intergovernmental Panel on Climate Change (IPCC, <http://www.ipcc.ch/>) noted that there was a 70% increase in Greenhouse Gas (GHG) emissions between 1970 and 2004. With projected increases in global economic activity, especially in China and India, curbing GHG emissions will become increasingly difficult over the coming decades.

The most common greenhouse gas is carbon dioxide (CO₂). Net CO₂ emissions (or CO₂ equivalent emissions) are becoming a proxy for the overall environmental impact of an individual or an organization. Net GHG emissions are calculated as GHGs generated less GHGs sequestered. (It is possible to sequester CO₂ by, for example, planting additional trees.) Sequestration may be accomplished by an organization itself or by purchasing emission credits associated with GHG emission reduction or sequestration projects external to the organization.

Resources exist to calculate the “carbon footprint” of an organization, i.e., the net CO₂ equivalent emissions (emissions less sequestration) during a year by that organization. (For example, see <http://www.carbonfootprint.com/USA/calculator.html> for a personal CO₂ emissions calculator.) An organization is said to be “carbon neutral” when its net CO₂ equivalent emissions are zero. Recently, over 70 presidents of US colleges and universities made a commitment to reduce greenhouse gas emissions (<http://www.presidentsclimatecommitment.org/>) by their institutions and approach “climate neutrality.” Several colleges, including Middlebury College in Vermont, have studied options for achieving carbon neutrality on their campus. And, the National Wildlife Federation (NWF) has initiated a program to support campuses that commit to carbon neutrality goals. NWF “Campus Climate Champions” commit to reducing carbon emissions by 2% annually.

The question for you this semester is “*What would it take to make Calvin College carbon neutral?*” Your answer to this question should take the form of a comprehensive plan for Calvin College to achieve carbon neutrality. The plan must be appropriate for the mission of Calvin College (<http://www.calvin.edu/about/mission.htm>), its history, and its present context. Elements of your proposed plan should include:

- An inventory of Calvin's present rate of GHG emissions and sequestration potential
- A detailed list of steps to be taken by Calvin to achieve carbon neutrality
- A schedule showing a timeline for implementing the plan
- Detailed documentation showing that the proposed plan will provide carbon neutrality
- A realistic plan to finance any capital projects that appear in the plan
- A financial evaluation of the economic costs of implementing the plan

Your deliverables are:

- (a) a final report that proposes a feasible plan for making Calvin College carbon neutral
- (b) two posters to be presented at the Calvin Environmental Assessment Program (CEAP) conference on Thursday 29 November 2007, and
- (c) a joint Biology/Engineering seminar on Wednesday 5 December 2007 in SB010 at 3:30 PM.

The customer for your report is Calvin's Vice-President for Finance, Henry DeVries.

The final written report should follow the technical memo format, including a two-page summary with

conclusions. The Executive Council is responsible for the introductory two pages and planning for the final report. Each team must provide a detailed appendix (in technical memo format, of course) to the overall technical memo that describes the analyses performed and the contributions of the team.

Your final report will consist of:

- (a) a paper copy of your final technical memo with extensive appendices,
- (b) an electronic copy of your final report (.pdf format, one single file), and
- (c) electronic copies of any programs or analysis tools that you developed during the project.

You must distribute copies of your final report to the VP for Finance, your supporting resources (see below), and the professors. You must also send a note of appreciation to your resources for their assistance during the semester.

To develop the required plan, you must first identify which areas you want to study this semester. These areas will be studied by 5 groups of 4–5 students each. Submit the list of study areas to Professor Heun by Wednesday 5 September 2007. The professors highly recommend that you organize the study areas following the outline of the Sustainability Statement recently adopted by Calvin College. So, for example, one group may be dedicated to researching CO₂ effects of Energy Purchasing and Use (item 4 in the Statement); another group may consider Transportation (item 7 in the Statement); etc. Note that item 9 (Campus Grounds and Land Use) is an area of opportunity for evaluating sequestration options.

After the study areas are defined, professors will select students to fill the groups for each study area. To apply for one of the available groups, prepare a cover letter and resume and deliver it to your professor by Friday 7 September 2007. Your cover letter should indicate the group in which you are interested and why you are qualified for that position. Groups will be announced in class on Tuesday 11 September 2007.

You may find it necessary to adjust the management structure as the semester progresses. Each group should select one individual to represent it on an Executive Council that provides coordination among the groups. All groups must arrange a tour of Calvin's existing physical plant facilities (including our co-gen plant) with Paul Pennock (see *Supporting Resources* below).

The first tasks for each group will be to (a) develop a schedule of your activities for the semester and (b) assess the contribution of your area to Calvin's current carbon footprint.

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 Calvin College Carbon Neutrality project. Each student must give either (a) one of the progress report presentations 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.

The in-class progress reports must include the following elements:

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

The final in-class oral report should provide the final technical details of your work, how your work was used in the final plan for your group, and the final conclusions for your group.

Bring printed copies of your in-class presentations for guests and the professors.

Although the customer for this report is the VP for Finance, your final grade will be assigned by the professors. Students will be graded on (a) the quality of their team's contribution to the overall effort of the classes and (b) peer evaluation. The professors, in conjunction with our external resource persons, will select an exemplary student for a teamwork award at the end of the semester.

Supporting Resources:

- Paul Pennock, Calvin Physical Plant: contact for physical plant tours and general physical plant information
(616) 262-9230 (mobile)
ppennock@calvin.edu (email)
- Henry DeVries, VP for Finance, hdevries@calvin.edu, 6-6148
- Chuck Holwerda, Electronics Shop, 6-6438
- Classroom learning on biology, exergy, economics, and thermal analysis
- Prior laboratory and lecture classes

BIOL 354 /ENGR 333 CCCN Project (2007)

Full-group project meetings are held Tuesdays 12:30–1:20 in the Bunker Center

Day	Date	Activity
Tue	4 Sep	Project introduction, objectives, deliverables
Wed	5 Sep	Group definitions due to Prof. Heun at 11:30 AM
Fri	7 Sep	Cover letters and resumes due to Profs Heun and Warners
Tue	11 Sep	Group assignments announced via KnightVision Project work day (BIOL354 & ENGR333 do not meet this hour)
Tue	18 Sep	In-class group presentations (7 minutes + 2 for questions) Report on objectives, work schedule, and proposed analysis approach
Tue	25 Sep	Project work day (BIOL354 & ENGR333 do not meet this hour)
Tue	2 Oct	In-class group presentations (7 minutes + 2 for questions) Report on analysis performed to date
Tue	9 Oct	Project work day (BIOL354 & ENGR333 do not meet this hour)
Tue	16 Oct	Project work day (BIOL354 & ENGR333 do not meet this hour)
Tue	23 Oct	Project work day (Academic Advising)
Tue	30 Oct	In-class group presentations (7 minutes + 2 for questions) Report on preliminary results
Tue	6 Nov	Project work day (BIOL354 & ENGR333 do not meet this hour)
Tue	13 Nov	Project work day (BIOL354 & ENGR333 do not meet this hour)
Wed	14 Nov	Project work day (BIOL354 & ENGR333 do not meet this hour)
Fri	16 Nov	Project work day (BIOL354 & ENGR333 do not meet this hour)
Mon	19 Nov	Project work day (BIOL354 & ENGR333 do not meet this hour)
Tue	20 Nov	Project final presentations (13 minutes + 2 for questions)
Wed	21 Nov	Project final presentations (13 minutes + 2 for questions) Report on final results
Thur	29 Nov	CEAP Poster Session
Wed	5 Dec	BIOL/ENGR Department Seminar 3:30 PM in SB010
Fri	14 Dec	Final report due at Noon