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2014 Fall ENGR333 Project Assignment

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Net-zero Homes Project

Fall 2014
ENGR333ab
Calvin College
Prof. Heun

Residential consumption accounts for a significant fraction (22%) of all energy in the US. (See Figure 1 below.)

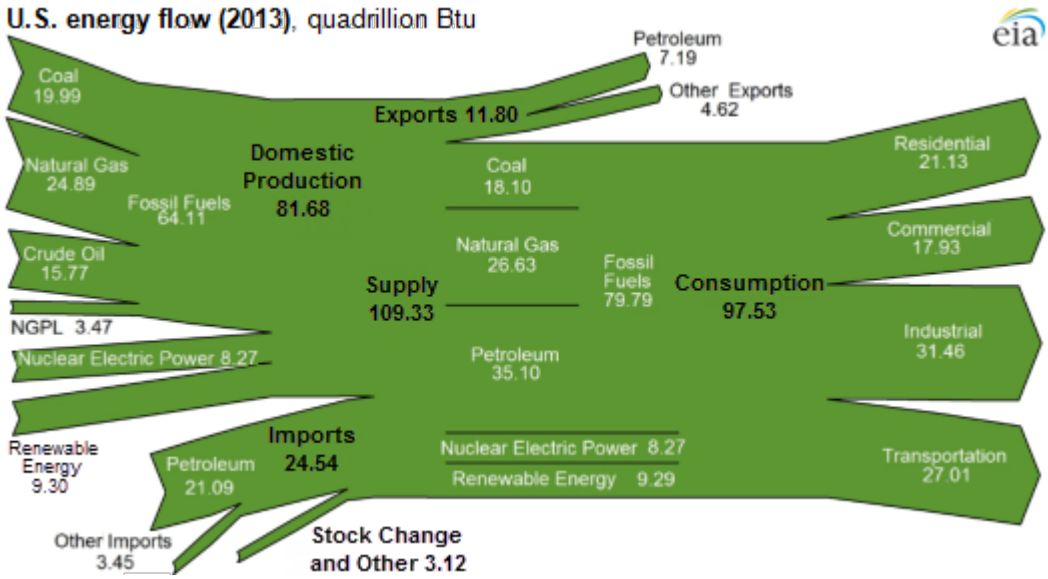

Figure 1. US Energy Supply and Consumption.
(Source: http://www.eia.gov/todayinenergy/detail.cfm?id=16511&src=Total-b1)

The *net-zero building* movement is an attempt to reduce the energy consumption of residential and commercial buildings. Net-zero buildings have equal energy production and consumption over the course of a year.

Your question for this semester is:

> *What would it take for a home in Grand Rapids to become net-zero?*

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

- What energy generation technologies are available to homeowners in Grand Rapids?
- What energy savings technologies should be employed to achieve net-zero status?
- How can energy production and savings technologies be implemented in homes?
- How can energy generation technologies be financed?
- How can energy savings be financed?

You will pursue this question in groups of 3–4 students each. Your response to the main question ("*What would it take…*") should take the form of a single report containing comprehensive and accurate information on your approach to achieving a net-zero building in Grand Rapids. A single final written

report must be submitted. Both sections (ENGR333a and ENGR333b) must contribute to the report. A suggested outline is a main technical memo with one appendix for each house. Each appendix should be its own technical memo. Each appendix must be thorough and provide the homeowner with enough information to make a wise decision whether to pursue a net-zero home.

The deliverables are:

(a) a final, combined written report for both sections that provides a detailed description of your work during the semester and a recommendation to each homeowner whether to pursue net-zero status for their home,
(b) an Engineering department seminar on **Tuesday, 2 December 2014** at 3:30 (venue TBD).
(c) one poster per group to be presented at the Calvin Environmental Assessment Program (CEAP) conference at 3:30 PM on **Thursday, 4 December 2014** (venue TBD)

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

The final report for the project will consist of:

(a) paper copies of your final technical memo with extensive appendices,
(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.

You must distribute copies of your final report (all three elements) to all customers and your professor. Final reports are due at the end of the final exam time for ENGR333b (Noon on Tuesday 16 Dec 2014). Each team must send notes of appreciation to each person who provided 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.

Each team is responsible for identifying both a home and a customer for their work. You will do well to ensure that at least one member of each team has a connection to a home to be studied.
Home: Choose a home in the Grand Rapids area that has the following characteristics:

a. easily accessible
b. energy records (electricity and natural gas) are readily available
c. has meaning to one of your group members
d. has an interested person who can serve as the "customer" for your group

Good options for a home include a parent's home of one of your group members, an off-campus house that you're renting, an on-campus home, the home of a Calvin staff member, administrator, or professor, etc.
Customer: Choose a customer:

a. for whom your study will be both relevant and meaningful
b. who can attend in-class progress reports (see **bold events** in schedule below)

Good options for customers include the homeowner or landlord for the home you select.
Please give the attached "Information for Customers" sheet to your customer.

During the first week, your tasks will be to select homes, select customers, and form groups. No more than two students from any single design team are allowed in the same ENGR333 group. Groups are encouraged to share relevant information throughout the semester. Each group must submit a 1-page

description of their group, project, home, and customer by **Friday, 5 September 2014** before lecture. The 1-page description must include a photo of your group in front of your customer's home.

After forming groups, an initial task for each group is to develop a schedule of your activities for the semester recognizes the dates of important events throughout the semester. Schedules must be discussed during oral progress reports (see below). Schedules must be coordinated with your customer.

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. Only 1 student may participate in oral progress reports and 2 students (at most) may participate 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 should not follow the outline above. Rather it should summarize the final technical details of your work, how your technical work was used in the final recommendations to your customer, and the conclusions for your group.

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

Despite the presence of an external customer for your work, the professor will assign final grades (possibly in consultation with customers). Students will be assessed on (a) the quality of their team's report, (b) peer evaluation, and (c) hours worked.

ENGR333
Net-Zero Homes Project
Fall 2014

Note: bold schedule items will include participation of customers.

Day	Date	Activity
Tue	2 Sep	Project introduction, objectives, deliverables
Fri	5 Sep	Team, homes, and customers due to Prof. Heun at class.
Tue	9 Sep	Project work day (Meet in the classroom for group work)
Tue	**16 Sep**	**In-class group presentations (7 minutes + 2 for questions) Use required outline.**
Tue	23 Sep	Project work day (Meet in the classroom for group work)
Tue	**30 Sep**	**In-class group presentations (7 minutes + 2 for questions) Use required outline.**
Tue	7 Oct	Project work day (Meet in the classroom for group work)
Tue	14 Oct	Project work day (Meet in the classroom for group work)
Tue	**21 Oct**	**In-class group presentations (7 minutes + 2 for questions) Use required outline.**
Tue	28 Oct	Project work day (Academic Advising)
Tue	5 Nov	Project work day (Meet in the classroom for group work)
Wed	12 Nov	Project work day (Meet in the classroom for group work)
Fri	14 Nov	Project work day (Meet in the classroom for group work)
Mon	17 Nov	Project work day (Meet in the classroom for group work)
Tue	**18 Nov**	**Project final presentations (15 minutes + 5 for questions) Report on final results.**
Wed	**19 Nov**	**Project final presentations (15 minutes + 5 for questions) Report on final results.**
Mon	1 Dec	Peer and Project Evaluations due (3:30 PM)
Tue	2 Dec	ENGR Department Seminar 3:30 PM (SB010)
Thur	4 Dec	CEAP Poster Session, 3:30 PM (SB010)
Tue	16 Dec	Final written report due by Noon

Net-zero Homes Project
Information for Customers

Fall 2014
ENGR333, Calvin College
Prof. Heun

Thank you for your willingness to serve as a "customer" for the net-zero homes project in ENGR333.

As you can see from the assignment for this project, the goal is for students to understand what it would take to make a net-zero energy home in Grand Rapids. The students will provide a report to you at the end of the semester that outlines steps that you *could* take in this direction. Students will make no modifications to your home during the course of this project.

The customer role is vitally important for student learning, making the project "real" to the students. By graciously volunteering your time and your home, you will provide the students with a real-world engineering experience that would otherwise have been impossible. As customer, you will support the students by providing checks and balances on their investigations, designs, and reporting, and you should feel free to raise real-world concerns and questions. (E.g., "Will the solar panels you're proposing cause any roof leaks?")

It will be very helpful to the students for you to provide the following:

- Historical energy consumption data for your house, including electricity and natural gas bills
- Access to your home for purposes of assessing energy consumption patterns, options for energy efficiency, and options for energy production. Students will pre-arrange meetings at times that are convenient for *you*.
- Suggestions, but not answers, for improving the energy efficiency of your home, based on your lived experience.

In addition, your presence at the following in-class progress reports will be essential. (Students must complete the table with the time and room number for their section):

		Time	Venue
Tue	16 Sep 2014		
Tue	30 Sep 2014		
Tue	21 Oct 2014		
Tue	18 Nov 2014		
Wed	19 Nov 2014		

Please note that all work on this project should be initiated and accomplished by the students. You are not expected to do any research, design, or report writing.

I have discussed with students expectations of professional conduct at all times. Please feel free to contact me if you have any questions or concerns about the project or the students.

Sincerely,

Dr. Matthew Kuperus Heun
Calvin College
Engineering Department
(616) 526–6663
mkh2@calvin.edu

Net-zero Homes Project
Peer and Project Assessment

Fall 2014
ENGR333
Prof. Heun

Throughout this semester, you performed analyses and worked toward net-zero energy for homes int eh Grand Rapids area. Now, your professor would like your feedback about the process. Part of your grade for the Net-zero project will be determined by the quality of your submission. Your response is and will remain confidential. Peer and project assessments are due at **3:30 PM** on **Monday 1 December 2014** in Prof. Heun's office.

1) Write one paragraph identifying one or two members of the class who performed exemplarily during this project. Provide examples of their supererogatory efforts.

2) Write one paragraph answering these questions: If you put this project on a resume, would you list it as "community service?" Does engineering (as a discipline) value volunteer work and community service? Why or why not?

3) Write one paragraph describing if or how your participation in this project caused you to alter your behavior this semester. Did you see any connections between your own personal behavior and energy efficiency? If you didn't change your behavior at all, describe why not.

4) What nontechnical skills did you learn in the course of this project? Do you expect that these non-technical skills will be relevant to your future work as an engineer? If so, why? If not, why not?

5) Write three paragraphs addressing this question: what are the connections between (a) energy efficiency and (b) the twin challenges of (i) energy resource depletion and (ii) climate change caused by global warming?

6) Write one paragraph detailing your role and contributions to your small group team. Conclude the paragraph by assigning yourself a letter grade for your work on the project. Justify your grade.

7) Write one paragraph each detailing the roles and contributions of the three (or four) other team members. Conclude the paragraphs by assigning a letter grade for your teammates' work on the project. [Total of three (or four) paragraphs and three (or four) individual letter grades.]

8) Write one paragraph indicating any topics relevant to the content of ENGR333 that, in your opinion, would be interesting for future classes to study. Also provide any suggestions for improvements to the structure of this project in future years.

When writing paragraphs assessing yourself and your peers, you may wish to use the following rubric.

Did the individual:

- Research useful information for your group?
- Display punctuality in meeting deadlines?

- Thoroughly complete assigned duties?
- Share equally in work performed by the group?
- Perform work of high quality or did their work often require revision?
- Help direct the group in setting goals?
- Help direct the group in meeting goals?
- Encourage group members to share ideas?
- Display empathy during group discussions and work?
- Listen to ideas from other group members?
- Participate in helping the group work together better?