

Michigan State University
College of Engineering; Dept. of Electrical and Computer Eng.
ECE 480 Capstone Design Course Project Charter

Sponsoring Company/ Organization: Lansing Board of Water & Light (BWL)

Contact Information:

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Background Information: In 2013, the BWL installed a Fuel Cell as a high tech, cutting edge, renewable generation resource for its new REO Town Co-Generation Facility. This product has failed to live up to it's high expectations. This particular installation included a networked inverter to monitor and switch voltage when needed. The fuel cell was also set up to provide a renewable hydrogen source to prevent the need for constantly replacing tanks.

Business Case:

- Explain why is this an attractive opportunity for your company to pursue now.
This project is an attractive opportunity because it presents the BWL with ability to gain further understanding of fuel cells to determine if they can and will become a reliable, renewable, clean source of energy. As coal plants continue to be taken off line, more options for clean fuel will be needed. This technology can also be a good fit to for distributed energy sources if proven reliable.
- Describe the discontinuity creating the competitive opening in the marketplace that makes this project timely. (Competitive action, Legislation, Regulation, etc.)
Not considered.
- Explain how this product / service will be positioned as a commodity (low cost to serve) or a differentiated (value priced) offering. Why?
Not considered.
- Outline the competitive barriers to marketplace entry the Design Team needs to take into consideration.
The fuel cell industry, while once considered having a very bright future, is now on the verge of collapse. During the installation of the project, two owners were involved, both of which are now out of business.
- What is the hypothesized basis of for a sustainable competitive advantage?
 - Patents, Trade Secret, Low cost, privileged relationships?
 - **Not Considered.**

Project Intellectual Property Considerations:

- Will the student Design Team be required to sign a Non-Disclosure Agreement?
The students will not be required to sign a Non-Disclosure Agreement.
- Will the Design Team be able to post their work on the course web site?
Post to the Design Team's course web site will be allowed. It is important to share the information gained from the project to benefit others involved in fuel cell research and maintenance.
- Will the student Design Team be working with technology contained in pending patents not yet granted?
The student Design Team will not be working with technology contained in pending patents not yet granted.
- Can the electronic design be shown, but the embedded software protected?
Again, the purpose of this is to learn more about the operation and maintenance of the fuel cell and all aspects of its inner workings. The expectation is that all information be shared to enhance fuel cell technology.

Opportunity Statement:

- What clearly defined Customer Problem you hope to solve with this project?
At the conclusion of this project, we hope to have an operational fuel cell delivering power to BWL's REO Co-Generation Facility and HQ. If this is not accomplished, the BWL would like a full report outlining the steps taken, tests performed and a full analysis of the findings with recommended next steps.
 - Is this problem solvable in a 13 week working semester with students?
I believe results can be achieved in 13 weeks.
 - Does the design challenge need to be run across two back-to-back semesters?
This should not be necessary.
- Does this problem exist now, or in the future?
This problem exists now. The fuel cell is ready for the project to commence.
 - How long will the window of opportunity be open to alternative solutions?
The Design Team's semester should suffice.
 - What will drive the window of opportunity closed in the future?
Newer more reliable and robust renewable energy sourcing coming on line.
- Who is the customer?
The Customer is the Strategic Planning Division of the Lansing Board of Water & Light.
 - Who makes the buying decision?
Anthony Fields is the project lead responsible for those types of decisions.
 - Who will the ECE 480 Design Team deliver their project to at the end of the semester?

The ECE 480 Team will deliver their project to the customer at the end of the semester.

- Describe the benefit to the end Customer for this project.
At the end of the project, the customer will have a working fuel cell or a detailed business recommendation on the future of our fuel cell.

Deliverables:

- Describe what is to be delivered at the end of the semester.
 - Proof-of-Concept design? (Bread-boards, wires connecting sub-systems, etc., ugly looking – but functional, development software non-user-friendly interface)
See Opportunity Statement.
 - Working prototype? (PC boards, cabling between sub-systems, refined software and user friendly interface)
See Opportunity Statement.
 - Sub-system ready to fit into the overall system? **N/A**
 - Final solution ready for end use deployment? **YES**

Goals:

- Describe what success will look like at the end of the semester.
At the end of the project, the customer will have a working fuel cell or a detailed business recommendation on the future of our fuel cell.
- Goals should be SMART
 - **Specific** – Exactly what is to be delivered?
See Opportunity Statement.
 - **Measurable** – Describe the measurement system that will determine the degree of success.
See Opportunity Statement.
 - **Attainable** – Can a student team, with little to no industrial experience complete this project in 13 weeks to your satisfaction?
Students with a solid electrical, chemical and physics background who are self-motivated and possess good problem solving skills should be able to complete this project.
 - **Relevant** – Limited to this design challenge.
 - **Time Bound** – 13 week working semester (Students loose a week getting organized and a week preparing for Design Week presentations.)

Scope:

- Clearly define what is IN and OUT of Scope for the Design Team. What are the clearly defined boundaries to prevent the project from getting too large and complicated?

As long as the deliverable is met, nothing will be considered out of scope. At the beginning of the project, a not to exceed budget will be in place.

- Clearly list chipsets, software, equipment, test set-ups, working systems, etc. that will be supplied to the Design Team to facilitate their efforts and keep project cost reasonable.

Students will be given all documentation collected on the fuel cell.

Constraints:

- List all constraints on the project team.
 - Examples include: Equipment the team must interface with, past Capstone Designs the team must build upon previous results, chip sets / software team must use in the design, etc.

Lack of documentation about the fuel cell. Lack of understanding of fuel cell technology. Location of fuel cell, i.e. the fuel cell is installed outdoors at the BWL's REO Town location, 1201 S. Washington Ave., Lansing, MI. These constraints might impact schedule.

Project Team: (Completed once semester begins)

Name	Responsibility

Faculty Advisor: (Assigned by ECE Dept . based on project requirements)
