CHEN E4231 Solar Fuels Group Project

Overview: Imagine that you and your team work for a consulting firm that has been hired by a large company or government agency to evaluate the technical and economic viability of a new solar-electrochemical technology or application. For this project, your primary objective is to evaluate (i.) whether or not the technology is viable and (ii.) provide a recommendation on whether or not the company/agency should invest in and/or move forward with developing this technology. Your recommendation must be supported by calculations based on the scientific and engineering principles you have learned in class, plus information that you obtain on your own. Your group's findings are to be communicated in a 4 page final report and a 15 minute presentation to be given in front of the "board of trustees" of the company/agency at the end of the semester.

Learning and process objectives: This project is based on a problem-based learning (PBL) philosophy that emphasizes work in small groups and self-directed learning (SDL) to tackle an open-ended problem that does not have a single correct answer. Educational objectives include i.) promote understanding of a broad framework of solar fuels technology, ii.) encourage critical and creative thinking about the design of solar fuels systems for real-world problems, iii.) learn to work effectively in teams to solve/evaluate complex problems, and iv.) learn to clearly communicate results and ideas.

Teams and project selection: Teams will consist of 3 or 4 students each. You may choose your teams and within the following constraints: (1.) your team cannot be only undergrad, MS, or PhD students. e.g. all three team members can't be PhD students, and (2.) your team cannot be made up entirely of students doing research group in Prof. Esposito's and/or Prof. West's lab. Once you have assembled your team, send a list ranking your top 2 project choices to the TA before (**Date TBD**) with the heading "Solar Fuels Project Selection".

General format: Both your report and presentation should contain the following components:

- **Introduction/background:** Describe the problem statement and technology that your group is trying to address. Fully describe the proposed technology with schematic(s) that clearly illustrate the entire process and important individual components. Highlight advantages and disadvantages of the proposed technology compared to current state-of-the-art technology.
- **Technical analysis:** Describe engineering calculations that you performed to evaluate the viability of this technology, including a description of key assumptions and the bounds of the study. Comment on the sensitivity of key output parameter(s) to variation in key input parameters.
- **Techno-economic analysis:** Perform a basic techno-economic analysis to predict relevant economic metrics such as levelized cost of energy (LCOE) and/or energy returned on energy invested (EROI) overall capital cost. How does this this compare to competing technologies?
- **Conclusions**: Is the proposed idea technologically viable? If yes, would you recommend investment in the proposed technology? Justify your answers.
- **References:** Include a list of references cited in your paper (not included in 4 page limit), and list key references (when appropriate) at the bottom of your slides used for your presentations.
- **Appendix:** Include any key equations used, plots, or schematics that back up key parts of your analysis that is discussed on the main report or presentation. For the report, include these as an appendix. For the presentation, you should include these items as back-up slides.

Due Dates:

- Date TBD: Turn in list of team members and your team's top 2 project choices
- Dates TBD: meet with Prof. Esposito and your project advisor at least once.
- Dec. 6th, 11th: **15 minute team presentations**. (presentation time limit will be strictly enforced)
- Dec. 11th: **4 page report** is due at the start of class. Additionally, each student should turn in a sheet of paper that explicitly lists each group member's contributions to the project.

Grading policies: This project counts as 25% of your course grade. The total grade for this project will be broken down as follows: report (45%), presentation (50%), update meeting(s) (5%). A grading rubric for both the report and presentation will be made available.