ENGR3360U Engineering Economics

Course Project Description

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Winter 2025

Overview

An important component of this course is the economic evaluation project. This activity **extends over a significant portion of the course** and is intended to allow students to review the various aspects required to conduct an economic evaluation **of engineering alternatives**. Students can liaise with the course instructor and Teaching Assistant as needed as they progress through the project. Students are expected to produce a project report.

Project Organization and Structure

Students will work on projects **in groups of five**. Where possible, each student should take on a separate activity and responsibility. A group may discuss the project with other students, but the submission for each group must be prepared only by that group. The project report should be word processed on a computer and submitted with a cover sheet (and other files) electronically on Canvas. **Each student who participated in a project should sign the cover page to indicate that she/he has done part of the work.**

Project Topic and Scope

Problem:

You and your group **work for a consulting company** that has been hired to study and produce a **preliminary economic assessment of energy production / cogeneration system** to serve the local community. The group will focus on the economic / financial side of the **project NOT on the design of the sub-systems.** In order to do this, the **NREL Software System advisory model (SAM**) can be used https://sam.nrel.gov/

Two major ideas are under investigation and must be compared:

PROJECT OPTION A)

Produce Electric power via a hybrid system made by **(for example):**

a) a PV / photovoltaic power plant
b) Wind farm
c) a Nuclear SMR able to satisfy the base load request.

This is an example. Other combinations can be analyzed. Note SAM from NREL does **not HAVE a NUCLEAR option.**

PROJECT OPTION B)

Produce Electric power (Total as in OPTION A) via a hybrid system made by (**for example):**

a) a CSP solar Power plant
b) a biomass energy system
c) a Turbogas able to satisfy the base load request. In SAM this is interpreted as conventional THERMAL.

Assumption is that **both options serve the same amount of people/needs / districts** (**essentially producing the same amount of total power for example 500 MW**) and are **located in the same area** (for example you could consider ONTARIO but could be very well somewhere else). Uses of the final electricity could be many as for example a Desalination power plant / hydrogen production / district heating and so on.

Please, before you start read well the **guidelines of SAM Software** posted on Canvas to understand the capabilities and economic tools used by the Software.

Recall each OPTION A or B has 3 power plants (of your choice) **all always working towards the production OF 500 MW of power during the year.** Maximum 1 sub-plant per OPTION can be the same: so you can have **for example** a PV plant in OPTION A and a PV plant in OPTION B, but all the other plants are/ must be DIFFERENT.

You are comparing the **HYBRIDS A (composed by plants A1, A2 and A3) vs B (composed by plants B1, B2 and B3).**

Note: the new released package for HYBRID systems (as of August 2024) allows to study some systems but **does not consider too many options. This means that it is NOT very practical for our project.**

Course Project Objectives:

Propose a configuration (**A vs B, which would be the one chosen?)** in this energy problem and analyze it with the use of the **typical Engineering Economics tools** determining for example the following (in the project annual cash flows):

a) Revenues from electricity sales and incentive payments
b) Installation costs

c) Operating, maintenance, and replacement costs
d) Loan principal and interest payments. What happens if different interest rates are considered? What happens if different payment scenarios (10 years / 20 years / 30 years) are considered?
e) Tax benefits and liabilities (accounting for any tax credits for which the project is eligible)
f) Incentive payments
g) Project and partner's internal rate of return requirements (for PPA projects)

Deliverables

The content of the four deliverables is listed below:

Deliverable 1) Literature Review and Investigation/ Alternatives

Proposal of type of **configuration A and B** are going to be examined. Note that depending on which type of configuration, data might be easier or more difficult to find / acquire/ verify. So it is good in this phase also to find data as much as possible. You must indicate the choice of your alternatives.

Deliverable 2) Cost Estimation

For each alternative (A & B) all model input parameters must be identified and put in a report. Questions that must be answered are:

1) Given the same amount of energy production what are **the major costs**?
2) How long should the horizon be for the investment? 5 years? 20 years?
3) What is the inflation rate? How does this influence the future revenues?
4) How are uncertainties addressed?
5) What is the replacement policy? What is the suggested / calculated MARR?
6) How are taxes or incentives influencing some of these results?
7) What is the payback period?

NOTE) Some of these **questions might find a full computed answer only** at the end of the semester or might have a different take at this stage as your engineering economics understanding develops or material is covered in class.

Deliverable 3) Final Report

A final report that must include a compilation of part one and the in addition to the economic evaluation model analysis and results justifying the **chosen alternative (A or B**). A word document as well as all other files used for analysis (excel).

Your report must include a one-page summary of how the team has functioned signed by all members.

Deliverable 4 & 5) Presentation & VIDEO (Team)

A presentation of work done is also expected (in PDF) accompanied by **a recorded oral one (Video with all team members).** Each participant should intervene and explain part of the project.

The FINAL REPORT should have the following structure:

Description	Weight	Due Date
Deliverable 1	15%	Feb 12, 2025
Deliverable 2	20%	March 12, 2025
Deliverable 3	60%	March 26, 2025
Deliverable 4 & 5	5%	March 26, 2025

Note: These dates are used a reference **but might be subject to change depending on specific circumstances**.

Grading

All marks posted on Canvas are allocated to the submissions and **may differ from the mark an individual may receive after the final deliverable is submitted.** Individual members in each group will be assessed according to feedback from their peers and receive an individual grade for the project (see Self- and Peer Evaluation provided on Canvas). The grade for each of the aforementioned submissions in the Deliverables section will be assessed on the following basis:

- Content (75%): creativity, accuracy and completeness of ideas and analysis details, logic and justification for research and analysis ideas.
- Clarity and ability to be understood (15%): clarity, conciseness, lack of confusion and ambiguity, use of language (grammar, spelling, etc.).
- Style and professionalism (10%): professional appearance, organization and structure (title, sections, etc.).

Self- and Peer Evaluation

A Self and Peer Evaluation Sheet will be provided to you after the project submission to assess the contributions and participation of individual team member on the project.

Filling the form is **mandatory by April 1, 2025**, and the results of the feedback will be used in calculation of individual project grades for each team member. The form will be made available via a link on Canvas.