Sustainable Energy Systems Portfolio (SESP)

Carleton University
Department of Mechanical and Aerospace Engineering
Main Focus

• In this project, the main focus is **ENERGY SYSTEMS**.

• We all know that this is a very important and timely topic.
  
  – Fossil fuels are becoming scarcer.

  – The new energy systems should be cleaner and sustainable.
Main Objective

• The main objective of this design project is
  – to optimize *the energy sources* for a *given location* in such a way that the supply mix can provide the energy needs of the region using cleaner and sustainable energy systems.

  – The focus is not only on a specific energy generation method but also *a system level* evaluation of the problem.
• For the past three years, the Canadian North have been considered as the region of interest.
https://www.sei-ind.com/
The main question then is what energy systems will be the optimum choice, considering the needs of a remote community and local conditions.
The town of Rankine Inlet

Power Cons.: 2.5 MW
Population: ~ 2411 (2016)

Agnico Eagle Meliadine Mine

Power Cons.: 28 MW (Co-generation Plant)
Diesel - Rankine Inlet

13,600 tons of CO$_2$ annual emissions

Cost $1.1 /L of fuel

Estimated annual cost of $5 M from fuel
Constraints

• The main task is to optimize the energy portfolio for the chosen location with specific constraints.

• Major constraints for the optimization include
  – performance
  – environmental impact of the portfolio (cleanliness, noise levels)
  – cost
  – sustainability
  – maintainability
  – accidents and mitigation
  – ....
An Integrated System

- Several design aspects (right location, proximity, load sharing etc.) need to be considered together.
Previously Built Hardware
Previously Built Hardware
Numerical Tools

- HOMER Pro
- EnergyPLAN
- RETScreen Expert
- MATLAB/Simulink
- ANSYS
Learning Objectives

• Understanding of the different energy systems and its applications

• Optimizing the energy portfolio for a specific region by considering various constraints such as performance, risk assessment, environmental impact, sustainability and cost

• Developing an understanding of the big picture design solutions

• Designing and testing the chosen systems to assess the performance, potential risks and their mitigation
Project Team

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• External Advisors
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