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Renewable Energy Solutions for Schools

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Abstract

This document outlines the project proposal for the individual project ENGR 489.

Written by Elliott Andrews and supervised by Jim Hinkley.

1. Introduction

The importance of energy production, their uses and costs has changed dramatically over the last few decades. The need to switch from non-renewable to renewable energy systems is key to reduce the impacts of global warming. Researching schools and their energy consumption is both interesting and valuable to the renewable engineering field.

The issue is that schools themselves, may find it costly or impractical to investigate current renewable energy systems. The project outcome will solve this problem by evaluating the best suggestions and solutions for using renewable energy generation in schools. Supported by research and evidence in the form of simulations and system costs.

2. The Problem

Many schools are still using old methods of producing energy. These include systems like hot water boilers for heating and fluorescent/halogen bulbs for lighting classroom buildings. Energy systems like these are not energy efficient and rely on electrical energy from external power stations. Even some older energy systems like coal burners rely on a finite resource of non-renewable energy.

It is important that we can provide schools with alternative and renewable energy solutions. Not only to drive the idea of making the change to using renewable energy but giving the overall practicalities.

The aims for this project are to:

- Evaluate existing renewable technologies and their costs from current suppliers.
- Present findings to schools based on their estimated seasonal energy consumption and potential energy production.
- Highlight the most practical solutions based on cost, viability, and possible energy storage.

3. Proposed Solution

We need to be able to present the predictions for schools using renewable energy systems like photovoltaic solar panels and wind fans. Conclude these findings and cost benefits to encourage and influence existing schools and future schools.

This solution will take the form of a final presentation, this will depend on the data we can collect and calculate. The presentation will be for schools and will meet all project aims.

Ensuring that this proposed solution is met, requires a project plan. The plan below is designed to show how this project will be carried out and identifying possible problems along the way.

Week	Planned activity	Possible problems / notes
5	Begin research, PV and wind systems, how they work and existing systems	N/A expect lockdown
6-7	Plan data needed - contact suppliers and research their products, organise data	Physical meetings only offered
8-9	Plan data needed - contact schools, introduce/meet in-person and organise data	Schools closed – terms holidays
10-11	Gather data on school locations elevation incline, tilt, experiment with tools	Software failure, data corruption
12	Produce some meaningful evaluation for at least 1 school - **Preliminary report**	Behind deadline, work in break?
1-2	TBD – present on preliminary report – begin/continue data preparation	TBD – replan for trimester 2?
3-4	Perform simulations, analyse, compare, and contrast results – calculate costs	Software failure, how costs calc
5-6	TBD – best presentation format, evaluate and write up findings	May need multiple formats
7-8	**Draft final report** – TBD for catchup, prepare for closing project	Need to plan time for drafting
9-10	Present findings to schools, report their thoughts on findings **- Project snapshot**	Schools unable to meet, reason?
11-12	Closing project – all data archived on GitLab access given - **Final report**	Data is multiple places, licensing
13	**Presentation slides submit – Presentation of work (conference day)**	TBD – requirements of events

Evaluating your Solution

This will be in a presentation form, to schools. Evaluation will also be assessed in the presentation context, with meeting these requirements:

- Overall solutions and conclusions are presented in a non-technical manner.
- Graphical representations to summarise energy production and consumption.
- Appropriate references to tools used, suppliers and schools.
- Maximum slides (if using PowerPoint) 10, time limit, no more than 20 minutes.
- Question and answer period allocated if available.

Apart from the presentation itself, project reflection should also be documented. The content to involve will address, what worked well, what didn't work well, problems encountered and overall assessment of how well the solution addresses the problem.

Ethics and Resourcing

I expect the following resources to be accessible and available to use:

- Solar View – Webpage at https://solarview.niwa.co.nz/
- PV Watts – Webpage at https://pvwatts.nrel.gov/
- System Advisor Model – Software downloadable at https://sam.nrel.gov/
- Microsoft Word – access and subscription provided by university
- Microsoft PowerPoint– (as above)
- Microsoft Excel - (as above)
- Microsoft Outlook - (as above) electronic written communication
- Zoom – another tool for communication

3.1. Ethics

I will be collecting energy consumptions and cost data from schools to compare against running costs of renewable energy systems. I expect that there will need to be some investigation into the data that we can collect, as well as our ethical responsibility, for how we handle, manage, and dispose of data we collect. There may also be concerns of privacy and publishing data that I need to consider.

I expect to apply for ethics approval via the university ethics form application. I will also most likely, be required to create a form, declaring data sharing, presented, and signed off by schools, who wish to participate in this project.

3.2. Safety

As well as the general guidelines for health and safety at Victoria University and in the labs, the specific health and safety documents can be found in this project's gitlab repository (requires ECS access). This project will not need any/nor cover any hardware or electronics.

3.3. Budget

The budgetary cost for this project is expected to be transport costs to and from schools.
The estimates will be centred from Victoria University of Wellington's Kelburn Campus.
Costs for using buses and trains with cash and tertiary snapper concession:

School (High School)	**Bus/Trains**	**Cost of travel and return**
Newlands College	22 and 52	$2.85 + $2.85 = $5.70
Onslow College	22	$2.14 + $2.14 = $4.28
Tawa College	22 and Kapiti Line	$6.81 + $6.81 = $13.62
*Costs for first time visit in person, any other visits required will be contacted by email, phone or zoom.		Total = $23.60

Space and Access

This project does not require the allocation of space to a specific room. However, I may be required to enter school grounds from various colleges, during or after school hours. The latter is preferable.

Intellectual Property

The Intellectual Property agreement for students has been signed by Elliott Andrews and Jim Hinkley. A copy of the signed agreement is available in this project's gitlab repository (requires ECS access).