EWB Challenge 2016: Vaccine Refrigeration System Design

BACKGROUND & MOTIVATION

There is a severe problem for the health clinics in Mayukwayukwa camp to store the vaccines and medicine. The current power used for vaccine storage is generated by solar panels and diesel generators, which cannot supply sufficient electricity for all appliances simultaneously. Thus the project aims to resolve power problem for vaccine refrigeration, providing a suitable storage temperature range of +2°C ~ +8°C.

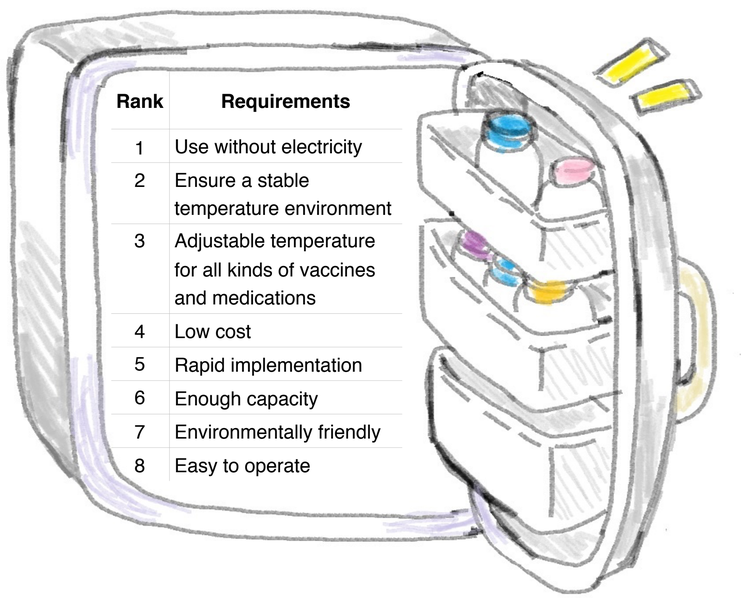
PROJECT ASSUMPTION

This EWB project has been built upon the following assumption on interpretation of 'without use of electricity': Developing a system of refrigeration system without any form of electricity; developing a refrigeration system using alternative electricity generation method. Two forms of refrigeration system have been developed concurrently.

PROJECT SCOPE

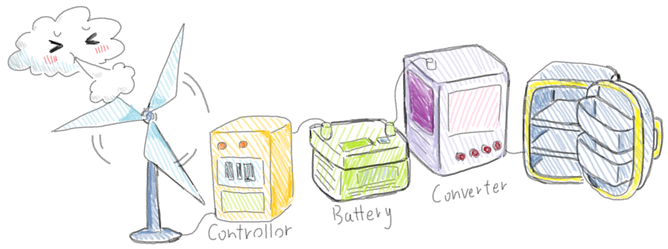
The project is mainly designed for the clinic as they have great demand for vaccines storage. The scope of the problem is defined to select the most applicable cooling methods which have the appropriate cooling efficiency or providing additional power system using local resources for relevant stakeholders.

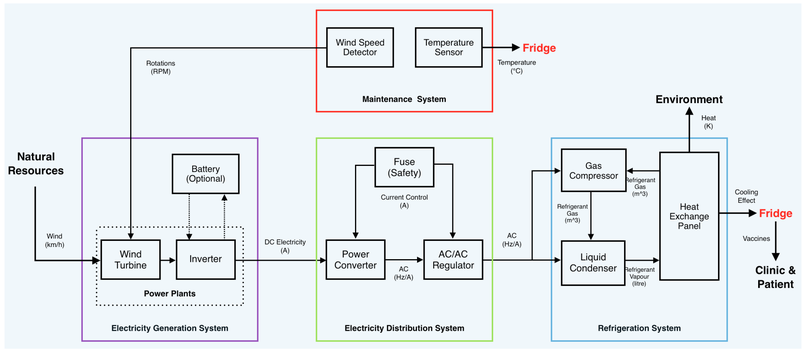
DESIGN REQUIREMENTS



Rank	Requirements
1	Use without electricity
2	Ensure a stable temperature environment
3	Adjustable temperature for all kinds of vaccines and medications
4	Low cost
5	Rapid implementation
6	Enough capacity
7	Environmentally friendly
8	Easy to operate

WIND POWER SYSTEM - IMPROVEMENT UPON GENERATION OF ELECTRICITY FROM SOLAR AND DIESEL POWER





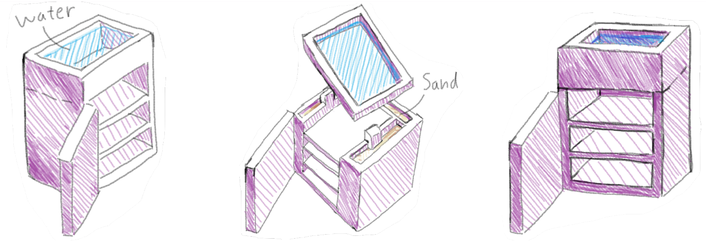
- Five main function steps
- Wind energy converted to electricity
- Electricity distributed to fridge
- Refrigeration cycle unchanged
- Heat extracted from inside

Due to the high standards and safety considerations in the power generation process in Wind Power System, the team recommends to use only COTS components.

ADVANTAGES	DISADVANTAGES
Industry level of cooling efficiency	Affected by wind speed
Stable cooling with continuously electricity supply	High cost complex system
	Still rely on electricity

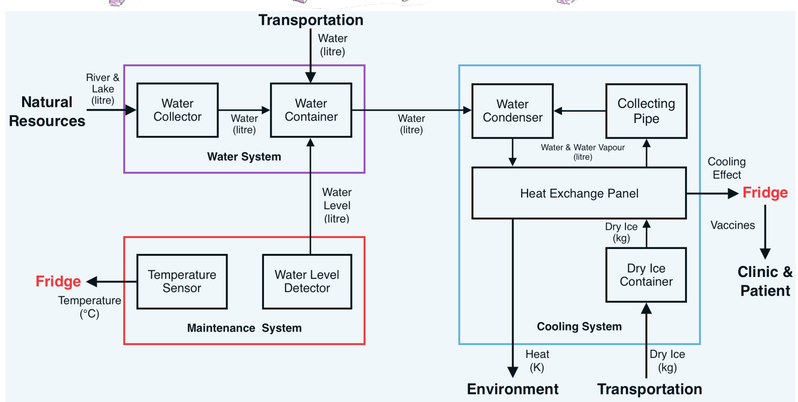
EVAPORATIVE FRIDGE - IMPROVEMENT UPON REFRIGERATION CYCLE WITHOUT USE OF ELECTRICITY

- Three main function steps
- Water stored in tank on top of fridge
- Water poured into sands between fridge walls
- Heat extracted by water evaporation



Evaporative Fridge's components are to be selected from modified COTS or custom products. This is because the system is expected to be constructed from a variety of flexible approaches.

ADVANTAGES	DISADVANTAGES
Electricity-independent system	Limited cooling range
Low cost and easy implementation	Highly depend on environmental factor
User friendly	Durability issues



FUTURE PLAN

- Identified future potential improvements: improving refrigeration cycle efficiency for Wind Power System; adding an electrical fan if permitted for Evaporative Fridge; developing safety and maintenance plans for both systems.
- Both systems are identified with pros and cons. Wind Power System is recommended to use in regions with high wind speed and existing electricity supply. Evaporative Fridge is recommended to use in regions with dry climate and without access to electricity.
- The next step is to seek feedbacks from clients and obtain information on detailed design parameters.

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