Innovation Concept Report

Group W3
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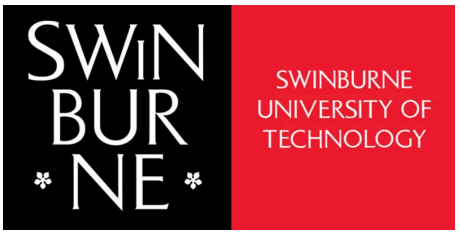

Part A:

1.1 Project Overview

The project's goal is to provide Tanh Linh Town which is currently experiencing a severe water shortage with long-term water solutions. The primary objective of this project is to install a solar-powered water purification system in order to ensure a steady supply of clean drinking water. Utilizing locally available resources, renewable energy sources and state-of-the-art filtration technologies the project will supply water to the community.

1.2 A Brief Introduction to the Identified Challenge/Problem

A number of issues including groundwater over-extraction pollution of nearby water sources and climate change are to blame for Tanh Linh Town's acute water scarcity. The inhabitants quality of life has decreased, there are serious health problems and there are financial difficulties as a result of not having access to clean water. Effective and sustainable solutions are critical since traditional water sources are either drying up or getting more and more contaminated. There are special difficulties in maintaining a steady supply of water in the town because of its geographic location and climate. The issue has been made more severe by the dependence on non-renewable energy sources for water pumping and purification rendering the system unsustainable from an economic and environmental standpoint. In order to address these issues a cost-effective and environmentally friendly renewable energy-based solution is offered by the suggested solar-powered water purification system. The technology lessens reliance on groundwater that is running out and lessens the harmful effects of pollution by using solar energy to provide a steady supply of clean water. In addition to addressing the current water crisis, this project aims to advance long-term sustainability, enhance public health and improve Tanh Linh Town residents' quality of life overall.

Part B: 5 design ideas and their uses

Design Idea 1: Solar-Powered Water Purification System

Description of the Design Idea

Communities are able to access clean safe drinking water thanks to a solar-powered water purification system. Solar panels, a multi-stage filtration system and water storage tanks are all integrated into this creative design. The system efficiently meets the urgent need for potable water by utilizing renewable solar energy especially in off-grid and isolated locations where conventional water purification infrastructure is either nonexistent or unstable.

Detailed Explanation of the Design Idea

What is contained in the system is:

Solar panels are gadgets that gather solar radiation and convert it into electrical energy.

Battery storage: enables you to utilize the energy generated by your solar panels during cloudy days.

Water Filtration Unit: Among other filtration stages this unit uses sediment filters and UV-sterilized activated carbon filters.

Pumping System: Pumps water through the filtration unit using the solar energy that has been stored.

Water Storage Tanks: Capable of storing both raw and refined water. After being extracted from a body of water (such as a lake or river) the clean water is stored in tanks for shared use after being filtered multiple times to remove impurities.

Design Specifications

Hardware prerequisites:

Superb photovoltaic panels for solar energy use.

Lithium-ion batteries are used: as energy storage devices in batteries. Sediment activated carbon and UV sterilizers combined to form a filtration unit.

Pumping System: Solar-compatible electric pumps.

Water Tanks: Sturdy high-grade storage tanks for water. The necessary software. Software to optimize the use of solar energy that has been stored is called an energy management system. Water quality and system performance are monitored by sensors and software in the monitoring system. Utility. Solar energy is captured by the panels and transformed into electricity which is then stored in batteries. The pumping system uses this energy to draw water and force it through several stages of filtration. Large particles are removed by sediment filters organic compounds and chlorine are absorbed by activated carbon filters and pathogens are killed by UV sterilization. In a tank clean water is subsequently kept until needed.

Benefits of the Design Idea

Sustainable: By employing renewable solar energy less dependence is placed on non-renewable energy sources.

Economical: After the initial setup there aren't many continuing costs because solar energy is free.

Scalable: Able to be adjusted in size to suit different community sizes. Social Impact. offers clean drinking water and reduces the incidence of waterborne infections both of which are factors in improved health. lessens reliance on fossil fuels and pollution which benefits the environment. Communities can invest in other areas thanks to economic development which frees up time and resources that would otherwise be used to get clean water. Respect for Cultural Diversity. The design is appropriate for the local way of life because it respects the environment and uses sunlight, a natural resource that is abundant in many areas. It can be adjusted to accommodate local water needs and water-use customs.

Guidelines Compliance

Access and Equity provide equitable access to clean water.

Health and Safety: By ensuring the availability of clean drinking water it promotes public health.

Affordability: With lower operating costs, this system becomes accessible to low-income communities.

Environmental Health: reduces harmful effects on the environment and promotes resource efficiency are two aspects of environmental health.

Sustainable Livelihoods: They give a consistent supply of water which raises living standards and fosters community development.

Constraints of the Design Idea

High initial costs: A substantial initial outlay of funds is needed for the purchase and installation of premium solar panels, batteries and filtration systems. For certain communities this might be a barrier.

Weather Dependency: Water production can be impacted by prolonged periods of cloud cover efficiency is contingent upon sunny weather. Through community funding subsidies and hybrid energy systems these limitations can be overcome making solar-powered water purification systems an invaluable resource for many communities.

Maintenance and Technical Expertise: The system must receive routine maintenance in order to continue operating effectively. This entails maintaining the pumps and batteries in good operating order, cleaning the solar panels and changing the filters. In remote locations it might be difficult to get spare parts and technical knowledge.

Water Source Variability: There may be differences in the water sources availability and quality. For instance during dry seasons rivers and lakes water levels may drop dramatically lowering the amount of raw water that can be purified. Furthermore, more sophisticated and expensive filtration systems might be needed for heavily contaminated sources.

Design Idea 2:

Rainwater Harvesting and Storage System

Description of the "*Rainwater Harvesting and Storage System*"

The Rainwater Harvesting and Storage System is created for the purpose of efficiently gathering, purifying and keeping water from rain for daily use. Examples of these include gutters, pipes as well as first splitters. The rainwater is collected by the gutters from the rooftop then enters into a network of pipes. These are used to convey the water to a tank where a first splitter takes away any initial flow coming

with dirt and chemicals that may be present in it. Afterwards, it goes through filtration processes including activated carbon UV technology hence making it safe for drinking and other purposes on a daily basis. A big tank has been installed so that there will be enough clean water supply for the entire community all through its operation period.

Design Specifications

The system's hardware prerequisites are gutters made of strong plastic or stainless steel that are used in the collection of rainwater from a rooftop and PVC pipes or metal pipes to transport water from gutters into tanks. The presence of first splitters composed of metal or plastic is very important since it helps in eliminating the initial flow, which might be containing pollutants. Huge food grade plastic tanks or metallic ones should be installed to store these treated waters. Filtration could be accomplished through an activated carbon filter as well as a UV purification unit for the eradication of microorganisms. Software requirements include a monitoring system with water level monitoring, filter condition monitoring and performance indicator with maintenance alerts and logging facility for water consumption also known as data logging.

How Does Our Design Idea Work/Function?

This Rainwater Harvesting and Storage System is organized through a number of stages. To begin, rainwater is trapped from the roof through gutters. After that, it is channeled into the system through pipes. The first splitter separates the flowing water which is potentially dirty with impurities and contaminants from the main tank. Clean water goes to the major storage unit while impurities are removed by passing it via activated carbon filter and microorganisms eradicated by exposing it to ultraviolet (UV) rays in an UV purifier. Ultimately, filtered water stays in another stand-by tank for ready distribution to users.

Benefits of Design Idea

The two primary benefits of this design are its economical water conservation and environmentally beneficial effects. Through efficient rainwater collection and utilization the system reduces the need for expensive water delivery services thereby lowering water bills and reducing reliance on municipal water supplies. Because less stormwater runoff causes erosion and water pollution it also benefits the environment.

Impact on the Community

By offering a dependable supply of clean water especially in places with restricted access to water this system greatly enhances water security. Effective filtration and purification lower the risk of waterborne illnesses which further improves health. It is also a useful resource for any community because it reduces the expenses related to the purchase and treatment of water.

Cultural Appropriateness

The design respects cultural norms and practices by ensuring that the system is easy to use, maintain, and integrate into existing community structures. It utilizes locally available materials and involves community members in the installation and maintenance processes, promoting a sense of ownership and sustainability. This cultural sensitivity ensures that the system is not only practical but also well-accepted by the community.

Benefits to the Community (Guidelines)

By making the system simple to operate, maintain and integrate into current community structures the design honors cultural norms and customs. To promote sustainability and a feeling of community it makes use of locally sourced materials and includes community members in the installation and maintenance procedures. The system's sensitivity to cultural differences makes it advantageous and well-liked in the community.

Constraints of Design Idea

The design has some shortcomings in spite of all of its advantages. Due to the high initial installation costs it might be too expensive for some communities to afford. To guarantee water quality and optimal performance gutter tanks and filtration systems need to be maintained on a regular basis which may call for some technical know-how.se.

Potential Challenges

The need for technical expertise and climate variability have been identified as two potential challenges when using this design for current and future needs. The system might not be able to collect enough water in areas with erratic rainfall which would require backup plans. A further drawback particularly in isolated locations could be the requirement for technical expertise to maintain and fix the system. Communities confronting water scarcity issues may find the Rainwater Harvesting and Storage System to be a useful and sustainable solution by addressing these limitations and difficulties.

Design idea 3: Community Greywater Recycling System

A community greywater recycling system is a network of water pipes, filters, water storage tanks to store, treat greywater and a system to redistribute treated water to households within the neighborhoods for non-potable purposes. This design idea can help Tanh Linh residents to reduce the amount of wastewater and turn it into irrigation water and reduce the pressure on freshwater resources.

Figure 1: Drawing of Community Greywater Recycling System

Design Specifications:

Hardware:

Diversion Valves: Installed on drain pipes from washing machines, showers, and baths to divert greywater into the recycling storage tanks. Heavy filter: A mesh filter used to remove suspended large solids from wastewater, like hair, food waste, and leaves from the greywater. (This filter needs to be maintained periodically every three months so the filter is not clogged.) Sand filter: One of Tanh Linh main terrain types is sand, so that we need to remove finer particles and impurities for further treatment.

Optional: Secondary Treatment (depending on intended use):

Biological and Disinfection treatment (e.g., UV light): Destroys organic materials and lessens water-borne diseases, especially for toilet waste.

Software (optional, if using a smart control system):

Software manages the water flow, the amount of water, controls valves, and optimizes system operation. Water leak detection software detects amounts of water through pipes which are attached with sensors

How Does Our Design Idea Work/Function?

Greywater which comes from showers, baths, and washing machines, flows through the control valve into the collection pipes. A heavy filter removes all the large debris to prevent the failure of the downstream treatment stages. Then it continues to flow through the sand filter to capture finer particles and impurities. Depending on the purpose, additional treatment may be implemented. Biological and Disinfection Treatment: destroys organic materials and eliminates bacteria and viruses, especially for toilet waste. Desalinated treatment: Treat desalinated water into pure water.

Benefits of Design Idea:

Reduce the reliance on treated water resources for non-potable tasks like irrigation, vehicle washing, and toilet flushing. Lower the overall community use of treated water. Greywater contains a lot of minerals and residual nutrients beneficial for non-fruit-bearing plants, reducing reliance on fertilizers.

Community impacts:

In terms of sustainable water management, the system promotes responsible water use and reduces pressure on freshwater sources. The system also increased community resilience by offering a reliable source of water for non-potable uses during periods of drought or salination seasons. Lastly, for environmental benefits: the system will reduce the burden of wastewater treatment facilities and wastewater drainage systems.

Reduce landslides:

Traditionally, Vietnamese people in general are used to exploring underground water resources for daily activities. However, these activities will have a negative impact on the underground terrain, in particular, causing serious landslides in the long term. Therefore, it is believed that the gray water system will minimize this impact at the same time enhancing the cultural appropriateness of Tanh Linh Community.

Benefits

Access and Equity: the system provides a non-potable water source with lower cost, meaning that low-income households do not have to depend heavily on collecting rainwater. Health and safety: it is obvious that the quality of non-potable water sources improved significantly, thanks to multiple technologies such as filters,

biological, disinfection treatment. Environmental Health: as mentioned above, the system will minimize the risk of landslides due to exposure to underground water.

Constraints:

Although the gray water recycling system offers several advantages, there are still constraints that need to be considered carefully.

Requiring significant literacy for local people:

Since the term gray water reuse is not popular among the community, significant literacy would be required to maintain safety. According to Renew magazine (2015), recycling water after being treated by the system has limited use, and residents should be acknowledged and educated thoroughly. As Gromicko (n.d) stated, greywater reuse is never potable the is still risk that it may contain micro-organisms or virus causing health problems if accidental cross-contamination of pipes occurs. Therefore, recycling water is forbidden to use for vegetables and herbs that are to be eaten raw or use directly for kitchen activities. Besides, it is also important to wash hands after contacting directly with recycling water. The instructions for local people that require significant effort and may become barrier due to their long-term daily habits, treating all water source in their household in the same way. Hence, it is crucial that authorities should find out proper solution to educated and make people aware of greywater after recycling contains potential health risks, end user must avoid direct contact.

Large initial investment and maintenance fee

As this system is not familiar to the local area, planning and setting up the system will require lots of effort and skilled labor. In the long term, observation and analysis should also be conducted to maintain productivity and increase efficiency.

Design Idea 4:

Water Storage and Groundwater Recharge Management System

Introduction

Land subsidence resulting from over-exploitation of groundwater is a major issue in many parts of the world including Tanh Linh which regularly faces water shortages during the dry season. The suggested water storage and groundwater recharge management system aims to address these problems by replenishing groundwater reserves with rainwater and excess water from drainage systems. This system promotes resilient communities and sustainable water management through mitigating environmental effects and optimizing groundwater resources.

Detailed Explanation of the Design Idea

Gathering rainwater and excess water from roads and residential areas requires effective drainage systems and training. To supplement the groundwater the collected water is fed into an underground system via wells and pipes that are specifically made for this purpose. By using all of the available water sources Tanh Linh will not flood or become flooded as a result of this process. Water scarcity during the dry season is lessened and traditional water sources are less stressed by the system's capture of runoff and rainwater.

After the water is gathered boreholes and a carefully planned drainage network are used to move it into the subterranean system. By ensuring that water penetrates deeper soil layers these systems efficiently replenish groundwater reserves. Toxic chemicals microbes and organic matter are eliminated from water before it enters the soil using sophisticated filtration systems such as activated carbon filters. Only safe clean water will contribute to groundwater recharge thanks to this multi-stage filtration process.

The sustainability of groundwater is ensured by the use of sophisticated water management techniques to control and balance groundwater levels. Water level monitoring and recharge rate evaluation are essential components of the system. Water input adjustments stabilize the aquifer and avoid over-extraction and the issues it brings with it including lowered water quality and land subsidence. Effective aquifer management promotes both environmental health and long-term water availability.

Benefits of the Design Idea

This system assists in protecting the environment by reducing groundwater overuse, stopping land subsidence and maintaining ecological balance. Droughts require maintaining groundwater levels for the benefit of the ecosystem and human consumption requirements. The system encourages biodiversity and reduces environmental stress by maintaining the natural water cycle. For industrial agriculture and everyday life to be possible there must be a replenishment of groundwater reserves to ensure a consistent and reliable supply. Through enhancing the quantity and caliber of accessible groundwater the system reduces dependence on fragile water supplies and promotes sustainable water resource control. By keeping steady water levels and avoiding overexploitation this systems implementation promotes sustainable groundwater management. Furthermore it supports long-term water

availability and environmental health both of which contribute to the resilience and growth of communities.

Impact on the Community

For a community to prosper there must be a clean dependable and sustainable water source. Residents' water security is improved by this system's stable groundwater supply guarantee. Clean water access gives communities the resources they need to prosper and is essential for both economic growth and overall health.

Communities that exhibit greater resilience to environmental and climate-related challenges are better positioned to pursue sustainable development. Thanks to the systems dependable water supply communities can withstand droughts and lessen their impact on the environment. By empowering communities to flourish in the face of hardship this advances more significant environmental objectives like the preservation of biodiversity and the mitigation of climate change.

Cultural Appropriateness

Incorporating regional customs and cultural practices enhances water resource management and preservation. This ensures that the system is both technically sound and supported by the community in a culturally appropriate way. It is feasible to more successfully adjust to community needs when local knowledge is respected and utilized. When the community participates in the development implementation and management of the systems a sense of ownership and accountability is promoted. Making use of regional knowledge and traditions guarantees the systems durability and effectiveness. Participation from the community lends credibility and support to the project increasing the chances of its success and long-term sustainability.

Constraints of the Design Idea

A sizable upfront investment is needed for the system. To cover this expense, support from the government, non-governmental organizations and community involvement is crucial. By carrying out a comprehensive cost-benefit analysis the investment is justified because it shows the savings and long-term advantages over the initial cost.

High levels of technical expertise are needed for both system design and management. The system's success depends on having qualified experts on hand for both installation and continuing maintenance. To ensure that the community has the necessary knowledge and skills training and capacity-building initiatives are required.

Challenges

Tanh Linh's geographic and geological differences could have an impact on system performance. For best outcomes areas with varying topography water tables and soil permeability require customized solutions. To ensure system effectiveness these

variations are addressed through thorough site assessments and tailored design techniques.

Climate change which includes irregular rainfall patterns may have an impact on the amount of water that is collected and replenished. In order to make the system adaptive to changes in water availability it is necessary to incorporate flexible design elements and management strategies.