S.O.L.A.R.W.I.S.E.

Solar-powered Optimization for Liquid and Aqueous Resource Wastewater Integrated Systems with Enhanced UV Filtration and Biofilter Efficiencies

Team S.O.L.A.R.W.I.S.E.


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PROPOSAL FRAMEWORK

1. THE BIG IDEA

1. Project Background and context

- Project location
  Puerto Princessa, Palawan, Philippines
- Main beneficiary
  Local Government, Buildings, Residents
- Problem statement
  Improper wastewater disposal practices in Puerto Princesa, Palawan – a UNESCO World Heritage Site, has experienced growing pollution impacting residents and the environment. This problem is also present in many parts of the world where lack of wastewater treatment is rising rapidly as population and industrial development grow. Thus, requiring an urgent and effective wastewater management solutions.

2.Project objectives

- Vision statement
  "S.O.L.A.R.W.I.S.E.: Today's actions shine upon the future that will rise."
- Clearly defined and measurable goals

a. Reduced Improper Greywater Disposal
   - ❖ Target
     100% greywater is treated and utilized back into establishments within 6 months of S.O.L.A.R.W.I.S.E. installation.
   - ❖ Measurement
     Monitor the tested establishment to provide an approximate volume of greywater disposed before and after S.O.L.A.R.W.I.S.E. installation.

b. Greywater Treatment
   - ❖ Target
     Ensure a usable treatable water supply in establishments.
   - ❖ Measurement
     Test and analyze greywater samples through standard laboratory testing before and after utilizing S.O.L.A.R.W.I.S.E.

c. Sustainability
   - ❖ Target
     50% reliance on renewable solar energy for greywater treatment.
   - ❖ Measurement
     Monitor and document water and electricity usage before and after S.O.L.A.R.W.I.S.E. installation through data logging and observation.

d. Maintenance
   - ❖ Target
     Utilize a device that checks on water level to notify the owner for maintenance.
   - ❖ Measurement
     Conduct tests for the device to detect water levels and calculate the acceptable accuracy range; and conduct real-world testing to monitor the device's ability to successfully send notifications and early warning features.

3.Project approach and methods

- Describe the approach and methods of your project to address the problem(s) and achieve the objectives (describe your solution!)

  S.O.L.A.R.W.I.S.E. offers a sustainable, multi-stage method for treating and reusing greywater from non-toilet plumbing systems that aims to address the rising problem of water pollution and improper greywater disposal.

1. Physical Treatment

- ❖ Chamber 1: Utilizes mesh filters with different hole sizes to remove and filter large particles and dirt from greywater. This serves as preliminary filter to prevent clogging in the next treatments.

2. Chemical Treatment
   - ❖ Chamber 2: Uses coagulation and flocculation to remove remaining pollutants. Suspended particles are clumped together as the result of chemicals such as alum and polymers bridge the gaps between these clumps for easy maintenance.
3. Biological Treatment
   - ❖ Chamber 3: employs biofilters which contain microorganisms that break down organic matter present in the filtered water to further reduce organic contaminants.
4. Mechanical Filtration
   - ❖ Chamber 4: With gravel and sand filters, the remaining particles in water are filtered out.
5. Disinfection
   - ❖ Overhead Tank: Utilizes ultraviolet (UV) light to ensure the treated greywater is safe for non-potable reuse by killing harmful pathogens.
6. Reuse

   The treated greywater from the overhead tank is returned to buildings for non-potable reuse, then the used greywater goes back into chamber 1 for physical treatment.

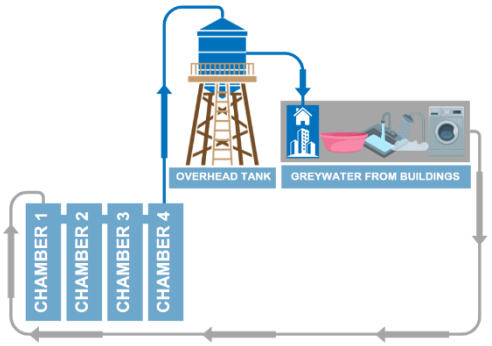

Figure 1. Wastewater Treatment Flow

- Describe how you are going to incorporate digital into your project

  Water level, temperature, turbidity, and pH sensors are connected to a Raspberry Pi via an Analog-to-Digital Converter (ADC), and IoT is utilized for real-time data transmission, enabling digital monitoring and analysis of S.O.L.A.R.W.I.S.E.

4.Project impacts

- Clearly define and quantify the expected outcomes and impacts
  a. Pollution Reduction and Freshwater Conservation
     - ❖ S.O.L.A.R.W.I.S.E. aims to achieve 100% greywater treatment for establishment use. By reusing greywater, the implementation of the project can help conserve freshwater resources.

  b. Increased Public Awareness for Water Responsibility
     - ❖ The application of S.O.L.A.R.W.I.S.E. enables establishments and homeowners to be aware of sustainable alternatives to greywater disposal in bodies of waters and septic tanks. This can encourage support within the community for environmental responsibility.

  c. Establishment Sustainability and Cost Saving Potential
     - ❖ S.O.L.A.R.W.I.S.E. has the potential to water and energy cost reduction in establishments.

  d. Scalability
     - ❖ The effective implementation of the project can work as a model for other areas dealing with similar greywater management issues, encouraging a broader environmental practices and investment in innovative and sustainable solutions. The application of S.O.L.A.R.W.I.S.E. can be expanded efficiently to serve a larger population and area.

2. THE PILOT

1.The Pilot Project

- Describe the concept of a small-scale implementation of your solution that can be done in 6 weeks

  The pilot project will be at Cebu Normal University (CNU) in Cebu, Philippines to test the effectiveness and feasibility of S.O.L.A.R.W.I.S.E. because of its proximity (team's university), existing infrastructure (lower cost and faster installation), and collaboration with the university's engineering and plumbing department.
- Define the scope and the objectives of your pilot project

  It will be conducted on a strategically chosen floor in CNU's eight-story Science building, considering factors like consistency greywater source, sufficient space for system components and access to plumbing and electricity for better integration.

2. Pilot Project Timeline

- Workflow and sequence of activity week by week for 6 weeks (March-April) to implement your pilot project

❖ Weeks 1-2
- ⌖ Select the target community and initiate discussions with local leaders.
- ⌖ Design and finalize the treatment system for the pilot and test.
- ⌖ Begin community awareness campaigns.

❖ Weeks 3-4
- ⌖ Install the simplified wastewater treatment system.
- ⌖ Integrate basic sensors for digital monitoring and testing.
- ⌖ Continue community engagement activities.

❖ Weeks 5-6
- ⌖ Monitor system performance and gather real-time data.
- ⌖ Assess community responsiveness and gather feedback.
- ⌖ Analyze digital monitoring results and make any necessary adjustments.

3. Stakeholder Mapping

- Identify which stakeholder that you need to approach and engage to ensure the success of your pilot project

  Stakeholders for the S.O.L.A.R.W.I.S.E project include local government authorities, tourism industry representatives, business owners, NGOs and environmental groups, academic and research institutions, and regulatory bodies, each playing a crucial role in ensuring the project's success and environmental sustainability.

4. Budget Plan

- Cost for site visit and engagement

  Utilizing the team's university (CNU) as the pilot location eliminates site visitation costs.
- Cost to build (including materials) and implement the pilot project

  The Bill of Quantities (BOQ) for the project includes excavation works at 5,000 PHP (approx. 90 USD), masonry works costing 5,000 PHP (approx. 90 USD), plumbing works totaling P5,000, labor expenses of 10,000 PHP (approx. 180 USD), filter materials procurement at 10,000 PHP (approx. 180 USD), other materials expenditure of 5,000 PHP (approx. 90 USD), and lab testing costs amounting to 10,000 PHP (approx. 180 USD), resulting in a total of P55,000 (approx. 990 USD)
- Maximum cost: 1,000 USD (Seed money)