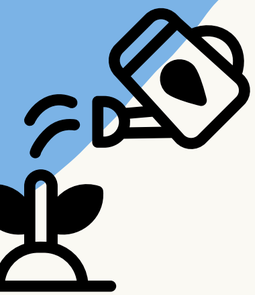
ECOFLUX STP

Turning waste into Resources

IDEA: A solar-powered portable STP that reuses the entire waste for agriculture, making sanitation eco-friendly and economically viable.



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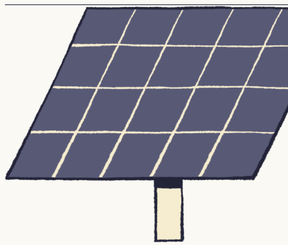
WHAT IS OUR PRODUCT?



- A solar-powered portable STP that treats and thus reuses the entire waste from public washrooms in rural and urban regions, for agriculture purposes! making sanitation eco-friendly and economically viable!
- Our model is tested for treating all types of waste of public washrooms, making it efficent and durable so that :
- Treated Water is Safe for irrigation, toilet flushing, and cleaning purposes.
- Organic Manure:Solid waste is processed into nutrient-rich, chemical-free manure useful for agriculture, nurseries, and local farms

- It all started with one essential question:

How can we redesign rural sanitation so that waste becomes a resource instead of a health hazard?

Why did we select this topic ?

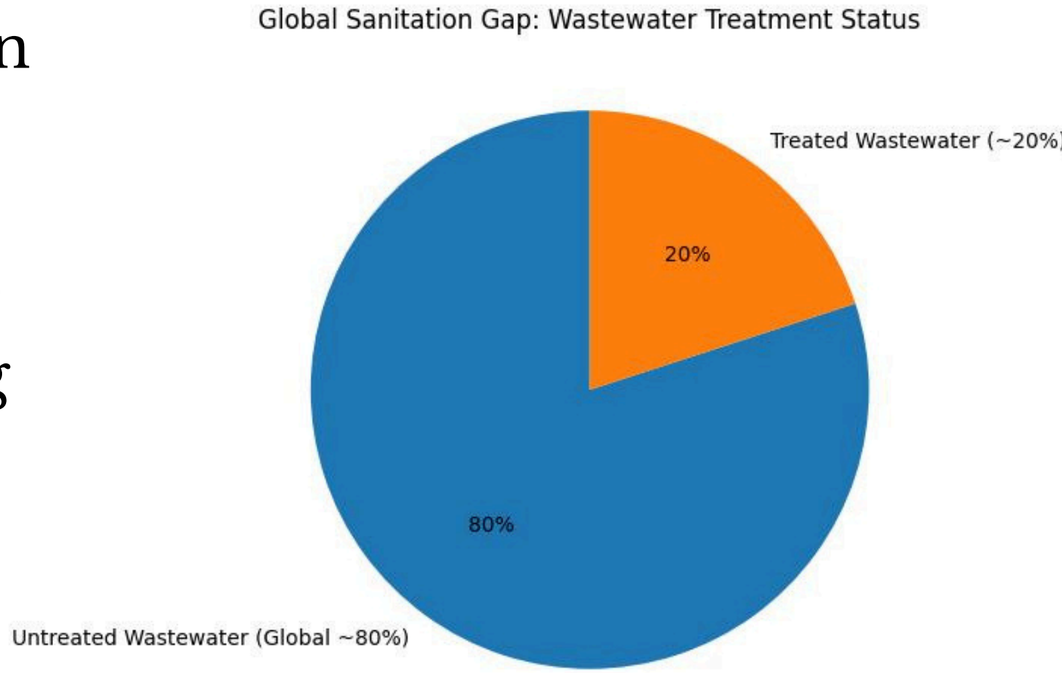
- The first time this problem struck us, was when the slum areas near my locality got **infected and more prone to dieases, mosquito bites and other problems after building of a public washroom.**
- When we **investigated and consulted our teachers,** we got to know that many washrooms do not have proper sanitation and lack in proper sewage treatment.
- Thats when we c**onsulted an entrepreneur** based in my hometown- Mr Atul who specialises in STP and water treatment and was kind enough to explain us the entire functioning, details and help us ideate our own modified version of a low maintenance STP.

open sewage through dense settlements.

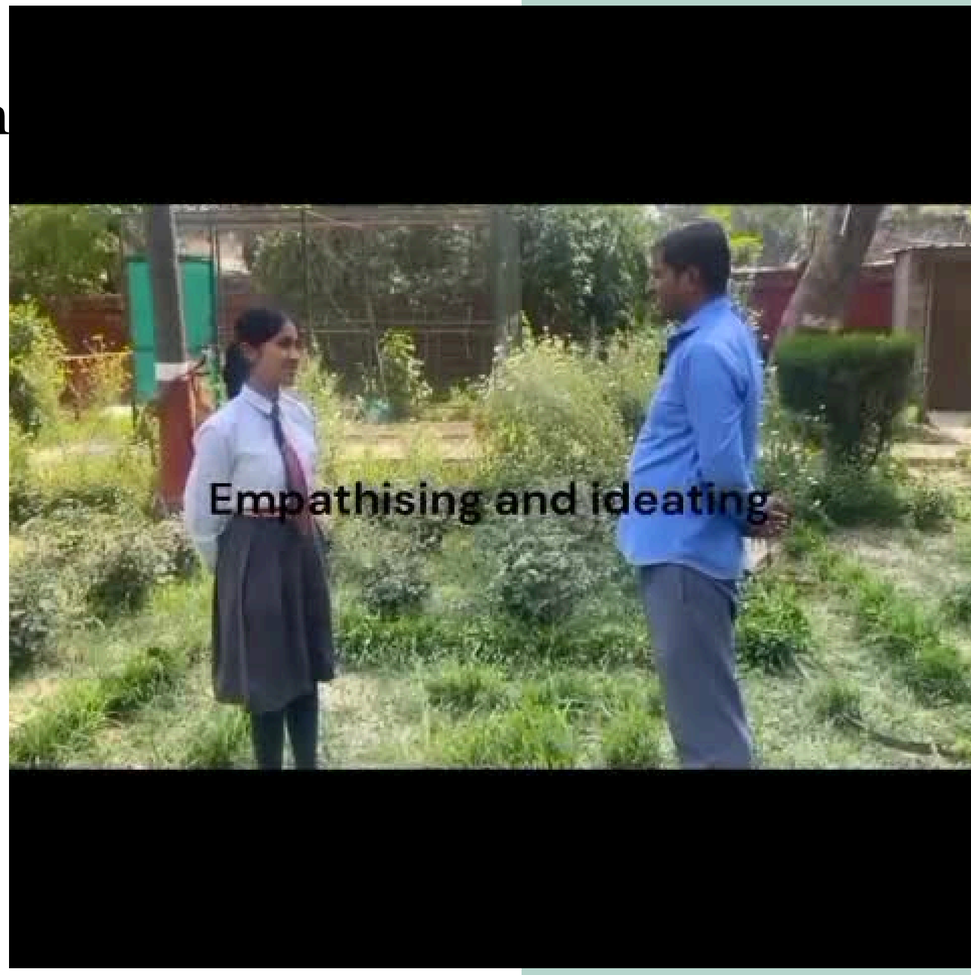
INVESTIGATION

Once we were aware about the untreated waste problem, we went onto a journey to **collect data online and connect with locals** who are actually facing the problem. We did **site visits to STP plants and primary investigation** through surveys hrough a bilingual form across the city to understand the actual need of people!

Our journey began with a disturbing observation of the "Sanitation Gap." Globally, 80% of wastewater is released untreated. In developing regions, this creates a "False Progress" where the presence of a toilet hides the reality of a leaking "Kachha" (unlined) pit.



- During our investigation, We met a farmer named Laxmi. Her children were frequently sick with waterborne diseases, yet she was spending a significant portion of her income on bags of chemical NPK (Nitrogen, Phosphorus, Potassium) fertilizer.
- We realized that the chemicals Laxmi was buying were th exact same nutrients she was flushing away. We weren't looking at "waste"; we were looking at a **misplaced resource**



- We took our findings to our school lab and investigated the properties of raw sewage (Blackwater). We studied:
- **BOD (Biological Oxygen Demand):** How untreated waste "suffocates" water by depleting oxygen.
- **Methane Emissions:** How open pits release greenhouse gases 28 times more potent than methane
- **The Pathogen Cycle**: How fecal coliform travels through soil into wells.

what we learned?

Social Insights: One of our biggest learnings was that sanitation is not just an engineering problem — it is a behavioral and systemic challenge.We discovered:

- Many communities lack awareness about post-toilet waste
- STPs often fail due to poor maintenance,
- Local ownership improves longevity
- Women and youth are highly receptive

to green skill training

This is why our model includes:

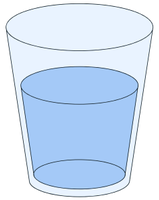
✅ pictorial manuals

✅ low-literacy training

✅ community-based maintenance

✅ IoT-based predictive alerts

How is it a real world problem ?



This is a $260 Billion Global Productivity Leak. It is a crisis that transcends borders, affecting over 3.6 billion people who lack safely managed sanitation.

- Open pits release **massive amounts of Methane** , a gas 25x more heat-trapping than co2. Globally, 80% of wastewater is dumped untreated.
- Farmers globally are struggling with the s**oaring costs of chemical fertilizers**, while the very nutrients they need are being dumped into "Kachha" tanks in the village square.
- **Case Study:** Whether it is a rural school in Sub-Saharan Africa, a pilgrimage site in the Himalayas, or a refugee camp in the Middle East—the problem is the same: **No Power, No Pipes, No Money.**
- The Reality: Our project proves that "Waste" is only waste if we waste it. This is the only way to achieve SDG 6 (Clean Water) globally without waiting decades for traditional sewage grids to arrive.

What challenge does our project address?

Rural regions and public washrooms are the mostly neglected in many regions as their waste is often stored in kachha pits or underground tanks, never treated.

Untreated sewage leads to:

- **Groundwater pollution, Land contamination**
- **Spread of fatal infections (cholera, dysentery, etc.)poor sanitation = huge health, social, and economic drain worldwide.**

- WHO estimates $260 billion per year lost globally due to poor sanitation.
- 80% of wastewater ends up untreated in the environment.
- Seasonal and rural unemployment and making progress in standard of living and economies of rural places

The Engineering Design Process

400 KLD STP @ IIT Kanpur

1. **Site Assessment:** We investigated the average waste volume per capita (approx. 1.5 to 2 liters of blackwater per use).
2. **Hydraulic Modeling:** We calculated the "Peak Factor." Since public washrooms are used most in the morning, the system must handle 4x the average flow for short bursts.
3. T**he "Portable Pod" Concept:** We decided against concrete structures. We designed a modular system that fits in a shipping-container-style frame, allowing it to be "deployed" anywhere within hours.

KPI - THE DATA OF SUCCESS

BOD Removal Efficiency

We aim to reduce the "Biological Oxygen Demand" by 90-95%.

Turbidity (NTU):

how much light can pass through the water. Lower is better.

Fecal Coliform Count:

The "Safety Metric." We aim for <100 units per 100ml

Solar Autonomy

We measure how many hours the system can run on "Battery Power" alone.

Specific Power Consumption

how many Watts are needed to treat 1 Liter of water. Our goal is the lowest SPC in the market.

WHAT SETS US APART?

ai generated rough vision of our product

- **Cost-recovery model** where selling treated water and manure offsets operational expenses
- Portable and solar-powered system that **works fully off-grid**, suitable for remote and rural areas.
- **Eligible for carbon credits** under waste-management and renewable-energy categories.
- **Creating jobs** beyond farming and strengthening rural empowerment. (Pictorial, low-literacy manuals and local installation teams enable smooth adoption)
- **Global Impact:Scalable across agriculture-based economies**,

HOW DOES IT WORK (TECHNICAL EXPLANATION) **?**

1. **STP Equalization Tank (The Buffer)**

the "Heart Rate Monitor" of the system. andles the "Shock Loading" when 50 people use the washroom at the same time. It ensures the downstream bacteria aren't "drowned" in too much waste at once.

2. **Aeration Tank (The Bio-Reactor)**

It houses the biomass. We maintain a specific MLSS (Mixed Liquor Suspended Solids) concentration to ensure there are enough bacteria to eat all the incoming waste.

3. **Air Blower (The Lungs)**

Instead of big bubbles, it makes tiny bubbles. Because tiny bubbles have more surface area, transferring oxygen to the bacteria much more efficiently.

4. **Settler / Clarifier (The Separator) and Breakup Water Tank (The Safety Valve)**

Uses Laminar Flow principles. By slowing the water, we allow the bacteria to sink to get clear water at the top, this tank prevents the whole system from backing up into the toilets.

5. **Filter Feed Pump (The Pressure Heart)**

As filters get dirty, This pump provides the "push" (measured in Bar or PSI) to keep the water moving.

6. Dual Media Sand Filter (The Physical Guard)
Uses graded pebbles and fine sand. It traps "Total Suspended Solids" (TSS). This makes the water visually clear and prevents the "cloudiness" that clogs irrigation pipes.

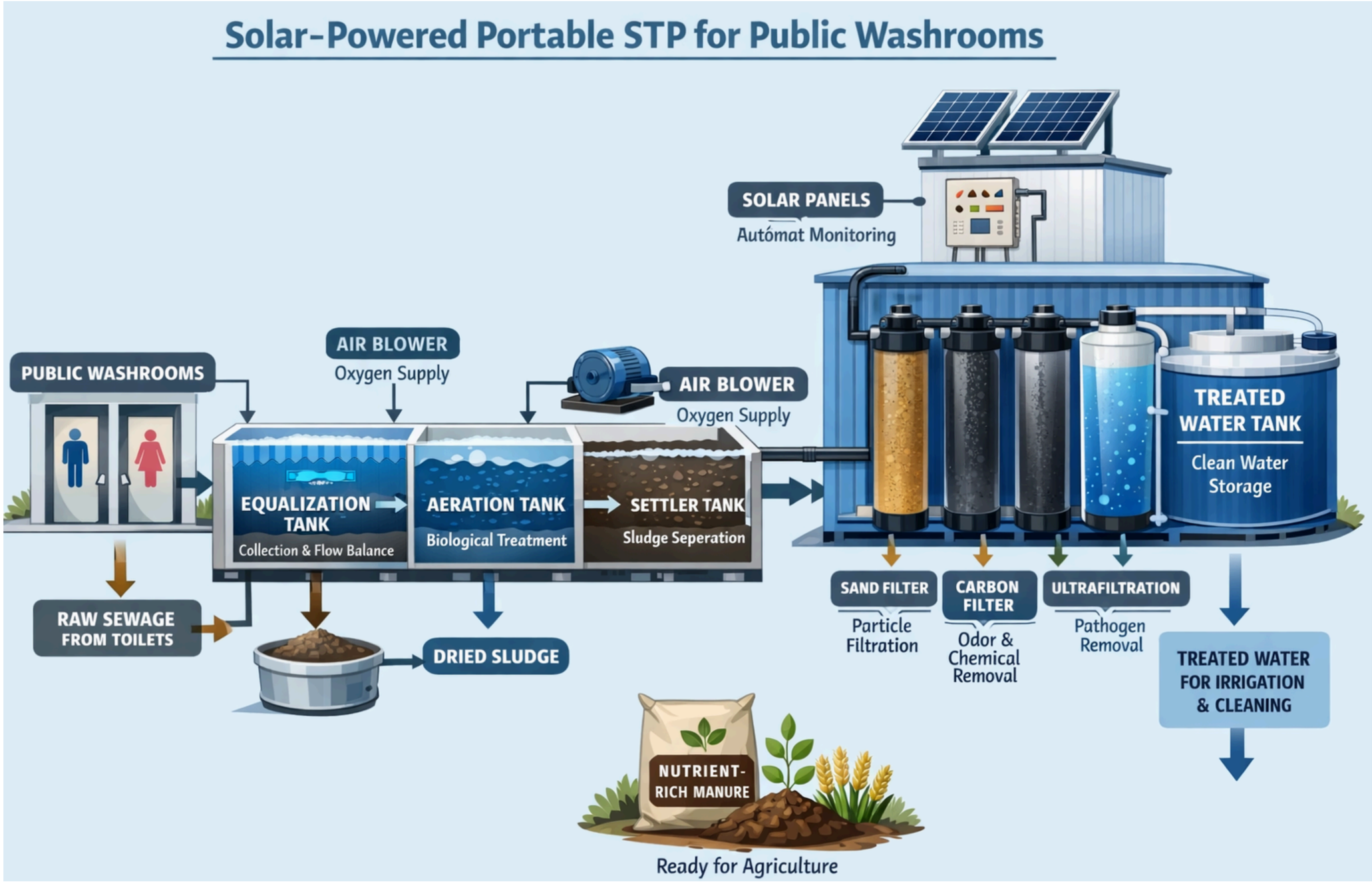
7. Activated Carbon Filter (The Chemical Guard)
It uses Adsorption to chemically bind to foul-smelling gases and chemical pollutants.

8. Treated Water Tank (The Reservoir)
This stores the "Liquid Gold." It is designed with a UV-resistant coating to ensure no new algae grow in the clean water before the farmer uses it.

9. Sewage & Sludge Motors (The Muscles)
These are "Vortex Impeller" pumps. Standard pumps clog with hair or waste; these create a whirlpool that pulls solids through without the parts touching the waste directly.

10. Agitator (The Mixer)
By keeping the mixture moving, it ensures that every drop of waste comes into contact with an oxygen bubble and a hungry bacterium.

Solar-Powered Portable STP for Public Washrooms



HELP TO SOCIETY

The "Green Goldmine" Revenue Model

- **Manure Sales:** The "Solid Gold." We recover the sludge, sun-dry it, and bag it as organic fertilizer.
- **Water Sales:** In villages, water is expensive. We provide a cheaper, nutrient-rich alternative for irrigation.
- **Carbon Credits:** Because we use **Solar** and prevent **Methane**, we can sell "Carbon Offsets" on the international market.

The Internet of Water (IoW)

Using **IoT Sensors**, we create a "Digital Twin" of the water.

- **Connectivity:** each STP sends its data to a dashboard.
- **Sustainability:** If the pH drops or a pump fails, the system sends an automated SMS to the local "Green Technician."

- **RESOURCES:**

- World Health Organization & UNICEF Joint Monitoring Programme (JMP) – Global sanitation access data (washdata.org)
- World Bank – Economics of Sanitation Initiative (WSP) – $260B annual loss (worldbank.org)
- United Nations Environment Programme (UNEP) – 80% wastewater untreated (unep.org)
- UN-Water World Water Development Report – Wastewater statistics (unwater.org)
- Intergovernmental Panel on Climate Change (IPCC) – Methane warming potential & wastewater emissions (ipcc.ch)
- SITE visits at IIT kanpur and contacting locals and entrepreneur specialised at STP and waste water treatments