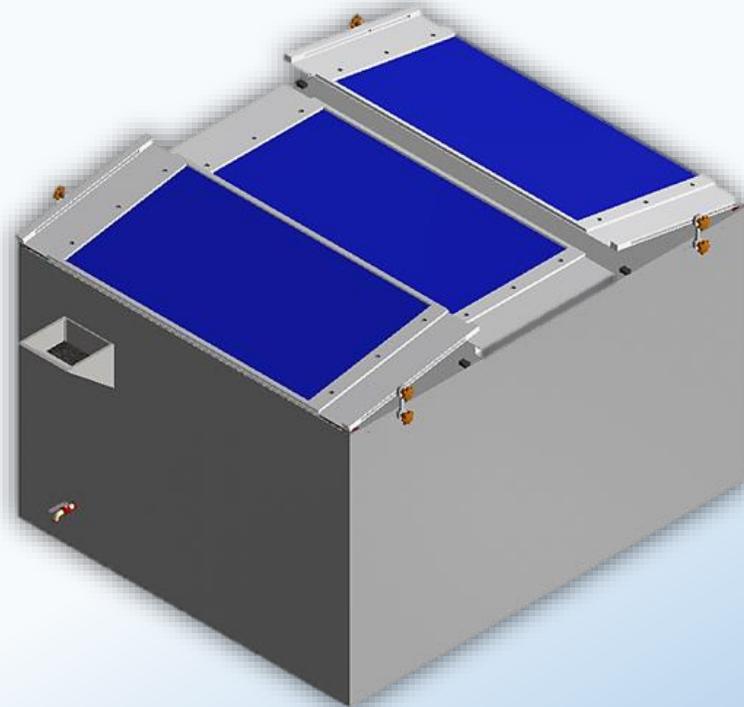
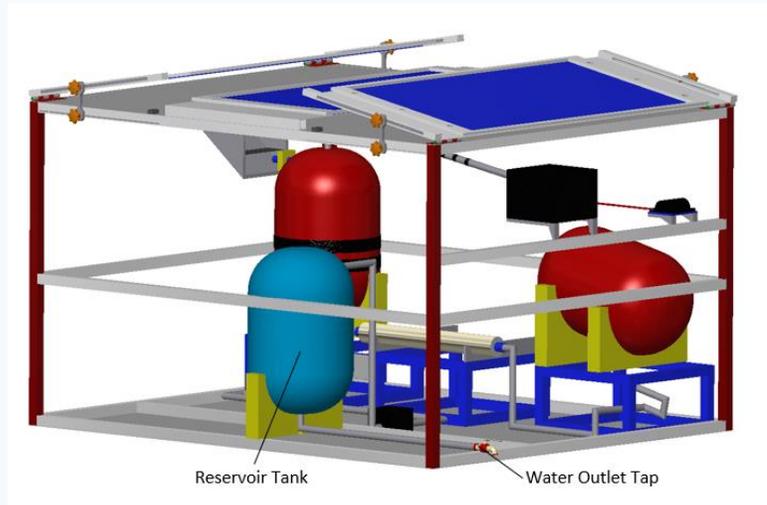


# A Solar Water Purifier for Developing Countries

By: Norah Alquwaie



# The Devastation..

The availability of clean water is currently one of the most rapidly expanding devastations in our global community.

Statistics based in Africa indicate that a child dies every twenty seconds due to waterborne illness and poor sanitation.

***“Every day, 6,000 children die of waterborne diseases”*** - UNICEF

The water being consumed in developing countries is usually **faecal polluted water**. This water contains **viruses, bacteria** and **microorganisms** resulting in infections and intestinal disorders commonly known as **diarrhoea, hepatitis, guinea worm, typhoid** and **cholera**.

The time, effort and health consumed by the lack of clean water hinders the development of these communities causes development almost impossible..



Their water vs. Our Water



Mother and children collecting water for everyday consumption

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Civilians travelling distances for water access (polluted) with heavy barrels on heads

# Research..

Developing an **affordable** solution for targeted communities.

Investigating water purification methods with mechanical aspects in mind..

**Activated carbon filters**

**Reverse Osmosis**

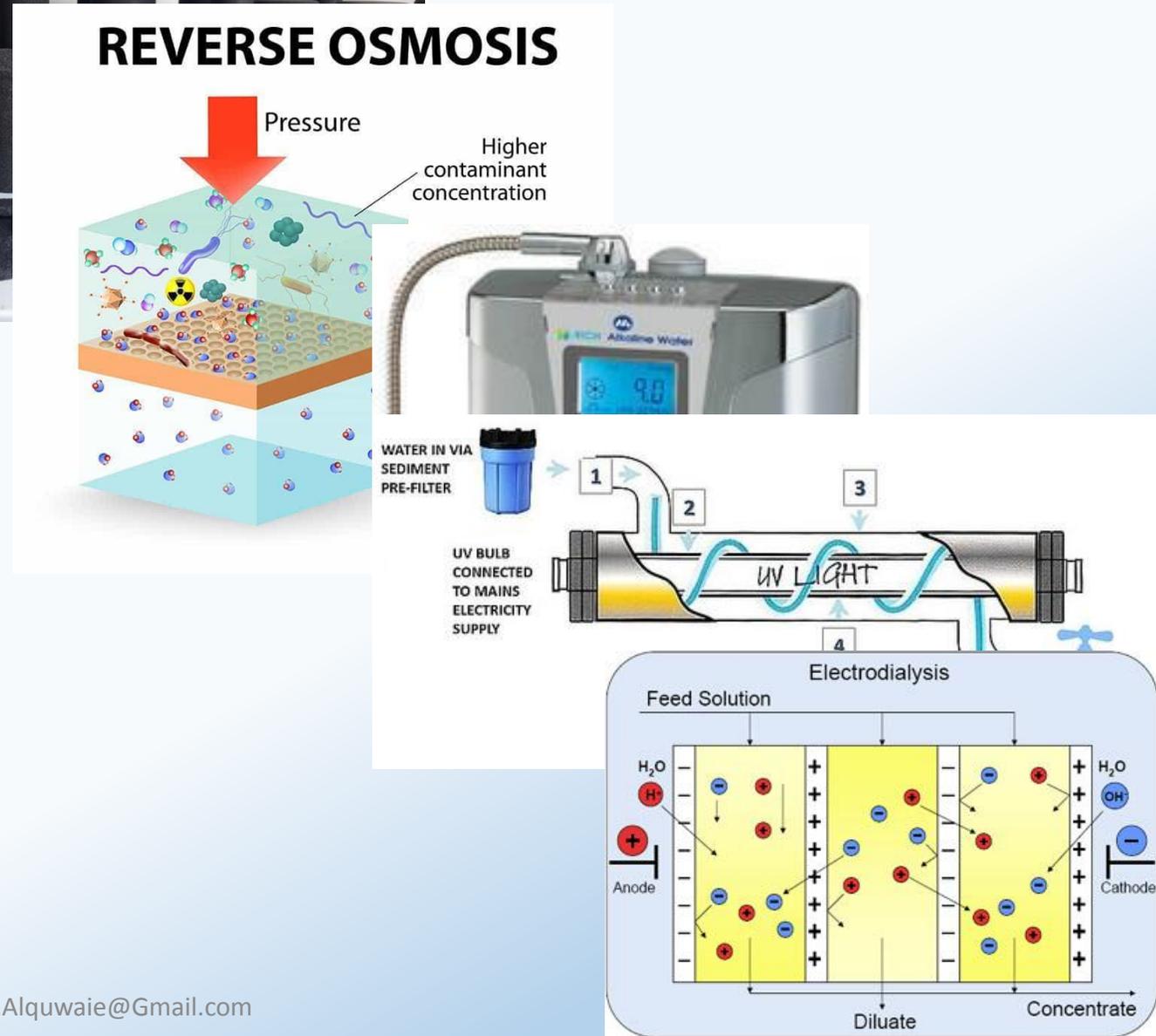
**Alkaline ionisers**

**UV filters**

**Electrodialysis (Proposed in M.I.T)**

Nothing resolved the issue with optimum performance..

**WHY??**



# Energy Constraints !!!

The main barrier , the main problem and constraint was the availability of energy

**Off-grid**, everything needs to be independently powered

**Energy limits everything...**

**Solar energy** becomes ideal yet still not very efficient due to its **low power output** requiring large areas to produce power to purify water

Research concluded that the water contained **too many sediments** making membrane purification unapplicable where it would require constant maintenance with resources unavailable in rural regions

Ideally, desalination is required which requires evaporation and distillation of water therefore boiling and phase change of water which consumes **A LOT OF ENERGY !!!!**



# Pressure Vs. Boiling Point

This relationship solves everything, critically altering the pressure of the atmosphere directly impacts the temperature of boiling water

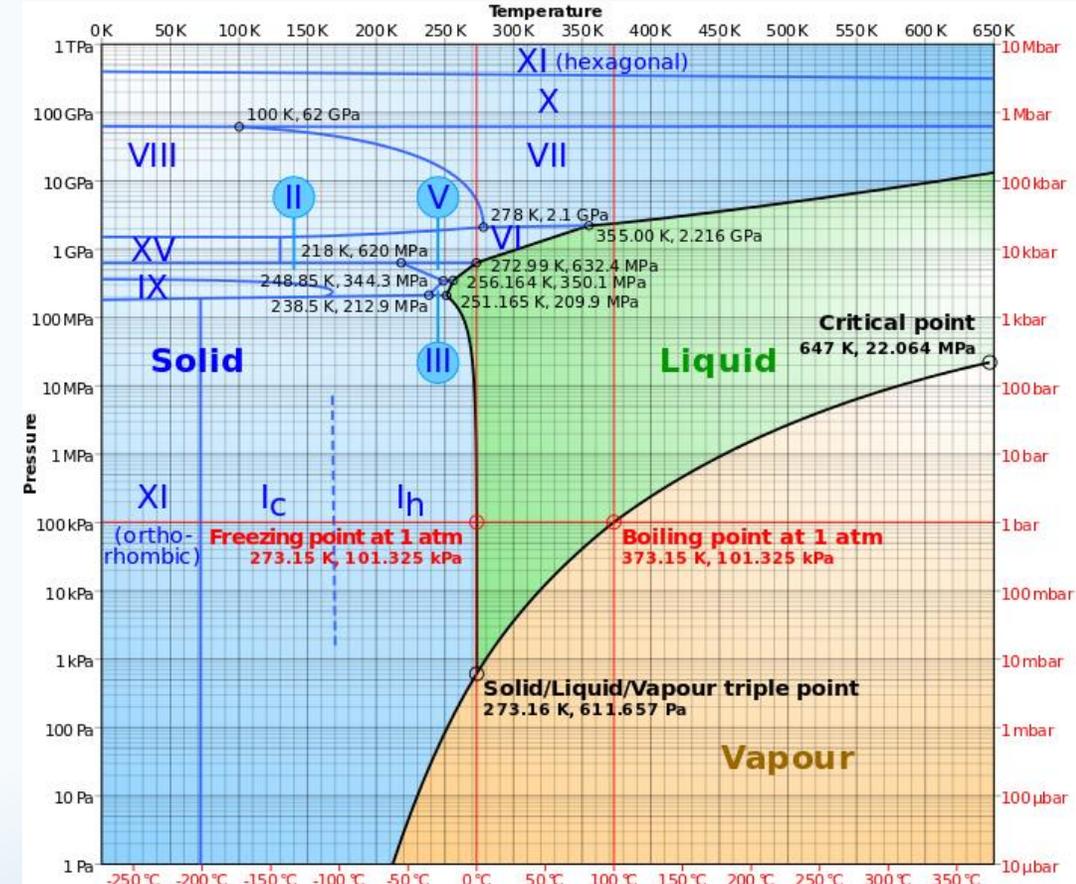
**Boiling -> Evaporation -> Distillation = SEDIMENT & SALT FREE WATER**

Desalination becomes possible at temperatures as low as 40 Degrees Celsius..

In the targeted regions this could already be the temperature of the water with minimal additional heat required

This makes the process achievable with the limited energy constraints, makes desalination possible..

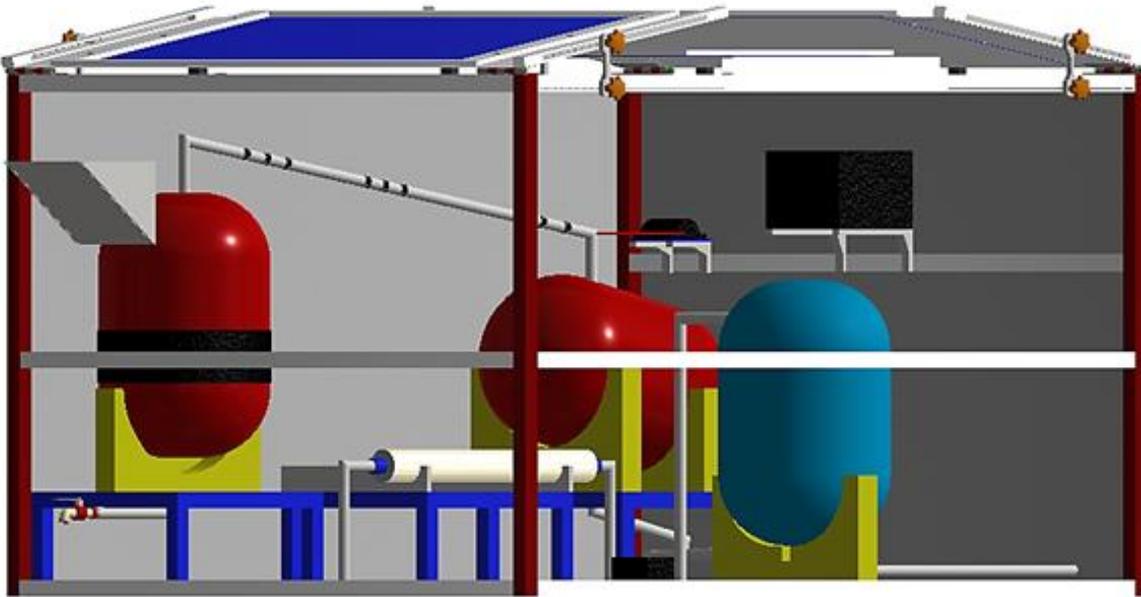
## HOW?



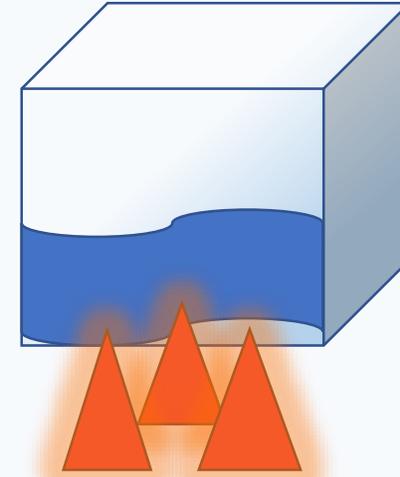
# Using a Vacuum..

A closed system implies the use of a vacuum which decreases the pressure in the tanks (Pressure vessels).

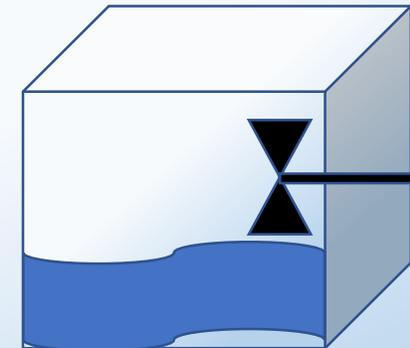
Lower pressure = Lower boiling point = Reduced Energy Consumption



Everything changes it is like defying the laws of energy,  
Performing a standard atmospheric system in outer space  
atmospheric conditions.



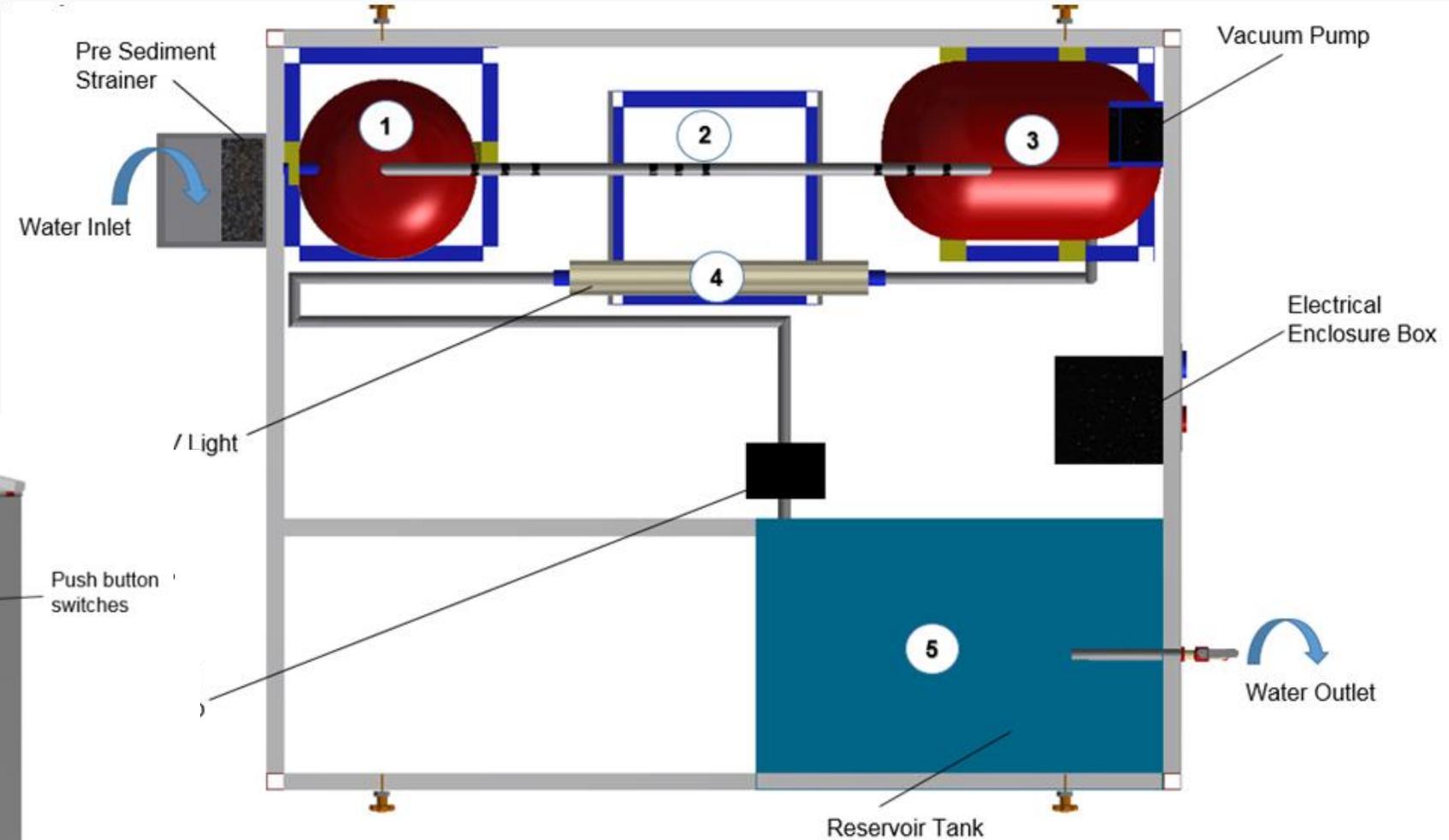
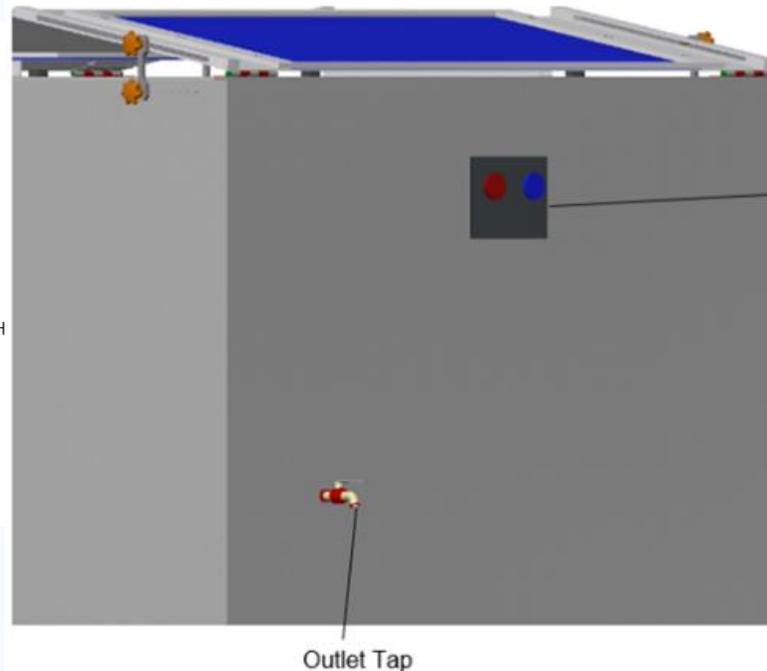
**POWER + POWER + POWER**



**CONSTANT LOW POWER  
(ROTATION)**

# The Developed Device & System

- Simple design
- Anyone can operate
- Ease of manufacture
- Low cost material
- Withstands environmental conditions



# Performance..

Water evaporation rate is mainly dependant on temperature and surface area of the water

The device consumes 1800 watts per day and results in a clean water output of 48 litres. Therefore, to compare the power consumption of the device with the amount of energy that would be used under standard atmospheric conditions, the atmospheric energy consumption was also calculated.

$$P_{DEVICE}/P_{TOTAL} = \frac{300 W}{5475.5 W} = 5.5 \%$$

Only consumed 5.5% of the energy if performed under atmospheric conditions..

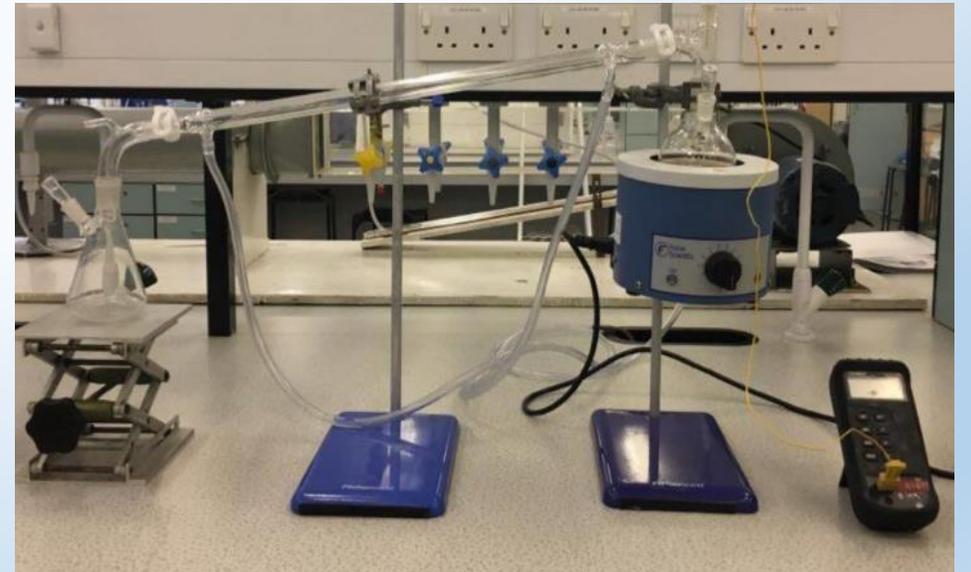
**ENERGY CONSUMPTION IS DECREASED BY MORE THAN 90%,,**



Water In



Water Out



# Applications of the System

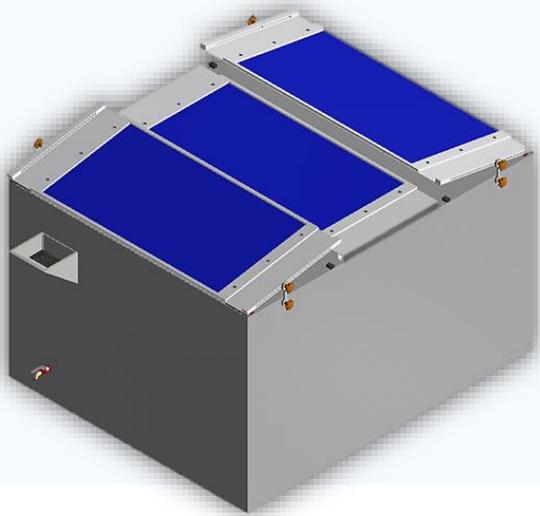
The device is designed with a UV light filter to destroy any bacteria and microorganism's which remain in the water after distillation

The water is not boiled at 100 degrees therefore UV light is essential to ensure clean drinking water

However , the **system** performs desalination it can be used in **various other applications** apart from the device such as modern water treatment plants in developed communities and industrial processes.

As previously indicated, **introducing the theory of vacuum distillation could lead to massive energy savings especially on an industrial scale ! \$\$\$**





# THANKYOU !

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## Questions ?...

