



# SOLAR POWERED WATER PURIFICATION USING REVERSE OSMOSIS

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**Abstract:** A renewable energy resource such as solar energy is constantly replenished and will never run out. Reverse osmosis is one of the processes that makes desalination (or removing salt from seawater) possible. Beyond that, reverse osmosis is used for recycling, wastewater treatment, and can even produce energy. Reverse Osmosis has however found use in several small-town areas. Here, the treatment of brackish water, with typically high levels of hardness or Fluoride content, has been favored by Reverse Osmosis as opposed to Ion Exchange and other technologies. In this project, we use solar energy to actuate the reverse osmosis process. We use 24V solar panel and 24V battery to store the solar power, So that during night time we won't be running out of power. Solar Powered Reverse osmosis water systems can purify water from any source such as rivers, ponds and bore wells and delivers safe drinking water, in addition these systems are highly suitable for military camps, village areas and fairs and tourist places where arrangement of temporary drinking water is a prime requisite at minimal price. Since Reverse Osmosis systems becomes cheaper and easier to handle the latest developments are to combine proven photovoltaic technology (PV) with proven Reverse Osmosis technology. The results is an economical solution that provides always clean water on a decentralized and renewable basis

**Index Terms** - solar panel reverses osmosis, sea water, and photo voltaic technology

## I. INTRODUCTION

Water is an essential Source for every living organism to survive. The only planet which consists of 70% of water is our Earth, In which 96.5% is salt water and remaining 3.5% of water is fresh. Due to rapid industrialization, its quality is under constant pressure. Preserving the quality of raw water is important not only for the drinking-water supply, but also for food production and other water uses. Water quality can be decreased by the presence of infectious agents, toxic chemicals, and radiological hazards. Water quality deterioration in distribution systems is mainly caused by inappropriate planning, design and construction or inadequate operation and maintenance and water quality control. This has been linked to a significant proportion of the burden of waterborne and water-related illness. Stresses on these systems caused by rapid urbanization, population growth and aging infrastructure further exacerbates the problems. The integrity of well managed distribution systems is one of the most important barriers that protect drinking-water from contamination. However, management of distribution systems often receives little attention. Distribution systems can incorrectly be viewed as passive systems with the only requirement being to transport drinking-water from the outlets of treatment plants to consumers. Reverse Osmosis is extensively applied in the water treatment industry as well as residential purposes. These applications include both the industrial sector as well as (to a lesser extent) the municipal sector. Reverse osmosis for the production of drinkable water is still not widely applied despite high feed TDS and low flow rate requirements being the prevailing characteristics for drinkable applications. The exception is of course the production of drinkable water from seawater by reverse osmosis, but this has thus far found limited application in India. Reverse Osmosis has however found use in several small-town areas. Here, the treatment of brackish water, with typically high levels of hardness or Fluoride content, has been favoured by Reverse Osmosis as opposed to Ion Exchange and other technologies.

### 1.1 Existing RO system

Existing RO system works on 240 V 50 Hz AC supply. This RO system is 4stage system such as pre filter, sediment filter, RO membrane, and ultra-filtration. In this RO system majority of elements are operated on DC supply hence 230 v AC is Converted into 24 V DC with the help of AC to DC converter. To light a UV tube there is required UV chock which is operated on AC supply and the water level switch is connected between the AC supply to disconnect the given supply when tank is completely filled by water. There is also solenoid valve to stop the flow of water when the tank is completely filled by water, to increase the pressure of the water flow there is booster pump which forces the water to flow through the filters and membrane.

## 1.2. Selection of water purification system

In Indian Railway, normally underground water is drawn through deep tube well to provide the safe drinking water to Railway premises. But where the extraction of underground water is not feasible and other sources of water not readily available, the treated water is been taken through municipal corporation of that area. Although Standards on the quality of drinking water has been laid down by organizations like BIS, ISO, Ministry of Drinking water & sanitation/Govt. of India etc., no standards have been laid regarding selection of appropriate/adequate purification system of water. Standards of quality of drinking water as per IRWM Annexure (physical and chemical standards) and Indian Standard - Drinking water - Specification (First Revision).



Figure.1.Dual media filter



Figure.2.Activated carbon filter

Filtered water from dual media filter is fed to activated carbon filter in order to remove free chlorine, organic compounds, colour and smells. The filter require backwash when differential pressure goes above 0.5Kg/cm<sup>2</sup> or when it stops giving desired output or after pre-decided time interval



Figure.3.Anti scalant dosing system

The commonly used reverse osmosis (RO) membranes consist of a polyamide salt-rejecting film on a poly-sulphone base. The very thin surface layer of polyamide (up to 3  $\mu$  m) provides the semi-permeable and salt-rejecting properties to the membrane. RO systems create salt



Figure.4.Ultra filtration Membrane



Figure.5.Solar panel

Table: 1 .Performance measures

S.NO	Sample Water	TDS Value before filter	TDS Value after filter
1	Bore Water	650	45
2	Drain Water	750	145
3	Sea Water	950	200

## II.METHODOLOGY

The project carried out by us made an impressive task in the field of water purification through RO method using renewable energy resource such as solar energy is constantly replenished and will never out. This work of operation is a simple assembly which is a good prototype to have a portable source of RO purified water. This has less weight and smaller size. By using solar power, we could able to purify the water with no running cost.

Specifications of the Equipment:

1. Solar Panel : 24v
- 2.High pressure pump: 0.5HP (80 PSI)
3. Battery : 2-series (12v)
4. Membrane Capacity: 4-5 ltr/hr
- 5.. Calculations

The Electricity Generated in Output of a Photovoltaic System is:

$$E = A \times R \times H \times PR$$

where,

E =Energy (Kw/h)

A =Total Solar Panel Area (M<sup>2</sup>)

R = Solar Panel Yield or Efficiency (%)

H = Annual Average Solar Radiation on Tilted Panels (Shadings Not Included)

PR = Performance Ratio, Coefficient for Losses (Range Between 0.5 And 0.9, Default Value = 0.75)

$E = (0.2 \times 0.25) \times 0.23 \times 35 \times 0.75$

E = 0.3018 Kw/h

E = 300 W/h.

### III.RESULTS AND DISCUSSION

The Electricity Generated In Output Of A Solar Panel (E) = 300w/h

Total Power Consumption = 34.5 W

Total Dissolved Salts (TDS) in PPM

1.Bore Water = 45

2.Drain Water = 145

3.Sea water = 200

Table 2 .Cost Estimation

S.No	Name of the Component	Cost(Rs)
1	Solar Panel	3000
2	Battery	1900
3	High pressure Pump	3000
4	RO Membrane	1000
5	UF Membrane	700
6	Carbon filter	800
7	TDS meter	300
8	Welding frame	500
9	Total	11200

Table.3 Materials used for project

S.No	name of the component	qty	material
1	Solar Panel	1	Silicon
2	High Pressure Pump	1	Stainless Steel
3	Battery	2	Lead Acid
4	RO Membrane	1	Cellulose Acetate
5	Carbon Filter	1	Charcoal
6	Ultrafiltration	1	Polyacrylonitrile
7	Anti Scalant Dosing System	1	Polyacrylic acid

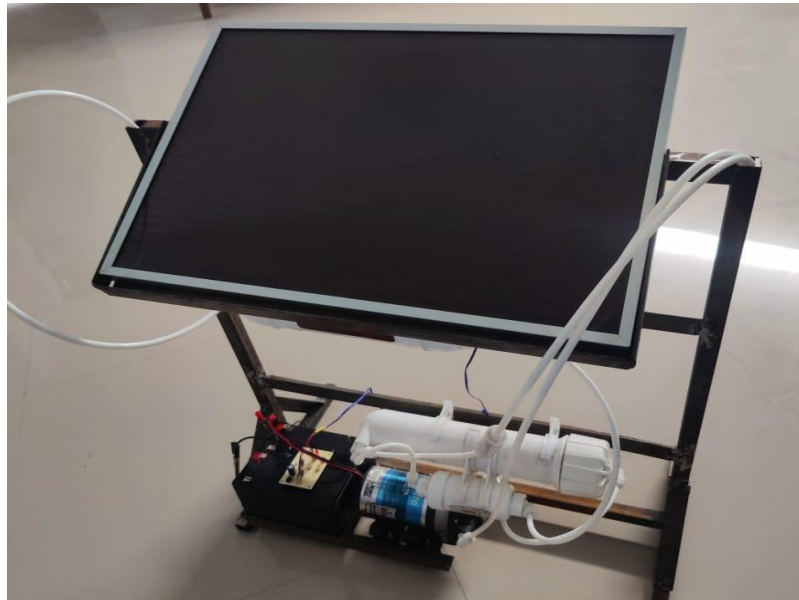


Figure.6.Final Working model

### III.CONCLUSION

The project carried out by us made an impressive task in the field of water purification through RO method using renewable energy resource such as solar energy is constantly replenished and will never out. This work of operation is a simple assembly which is a good prototype to have a portable source of RO purified water. This has less weight and smaller size. By using solar power, we could able to purify the water with no running cost.

### IV.FUTURE SCOPE

Solar powered reverse osmosis systems are a new concept in Indian water purification industry. Renewable energy resource such as solar energy is constantly replenished and will never run out, so that during night time we won't be running out of power. Reverse osmosis water systems can purify water from any source and can deliver safe drinking water. These systems are highly suitable for military camps, village areas and fairs and tourist places where arrangement of temporary drinking water is a prime requisite at minimal price.

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