Environment & Ecology · GS - III

The world is facing an acute shortage of clean and safe freshwater. What are the alternative technologies which can solve this crisis? Briefly discuss any three such technologies citing their key merits and demerits.

EXAM YEAR	PAPER	SUBJECT
2024	GS - III	Environment & Ecology

MARKS	WORD LIMIT
15	~250 words

Answer Hint

Freshwater scarcity, desalination, wastewater recycling, rainwater harvesting, membrane technology, water purification, sustainability, energy intensity

Model Answer

Introduction

Freshwater scarcity is intensifying due to population growth, urbanisation, pollution, over-extraction and climate change. Alongside conservation, technological interventions can expand the usable freshwater resource.

Body

1. Desalination

Desalination converts seawater or brackish water into freshwater using processes such as reverse osmosis.

Merits:

It provides a relatively reliable water source for coastal cities and reduces dependence on stressed freshwater bodies.

Demerits:

It is energy-intensive, costly and produces concentrated brine that can harm marine ecosystems if inadequately managed.

2. Wastewater Treatment and Recycling

Advanced treatment technologies can convert municipal and industrial wastewater into water suitable for agriculture, industry and, with advanced purification, potable use.

Merits:

It creates a circular water economy, reduces freshwater extraction and lowers pollution loads.

Demerits:

High-quality treatment requires substantial investment, energy and effective monitoring. Public acceptance can also be a challenge.

3. Rainwater Harvesting and Managed Aquifer Recharge

Rainwater can be collected from rooftops and surface catchments and used directly or directed into aquifers after suitable treatment.

Merits:

It is decentralised, relatively inexpensive and helps recharge groundwater while reducing urban runoff.

Demerits:

Its effectiveness depends on rainfall patterns, storage capacity and local hydrogeology. Contaminated runoff can also pollute groundwater.

Conclusion

No single technology can resolve global freshwater scarcity. A combination of desalination, wastewater recycling, rainwater harvesting, conservation and demand management can create a more resilient and sustainable water system.

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