

Solar-Powered Water Desalination: Taking Water From Thin Air

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Introduction

- The world is having a water crisis that affects more than a billion humans per year ²
- Many underground water reservoirs are almost depleted and most are non renewable ²
- Desalinating water helps with groundwater shortages, but can usually result in harmful effects for the environment ³
- A new solar-powered water desalination system built by a MIT team can help off-grid arid coastal areas receive fresh water ¹
- This system uses renewable energy, is extremely low-cost and energy-efficient compared to other systems, and better for the environment ¹

How It Works

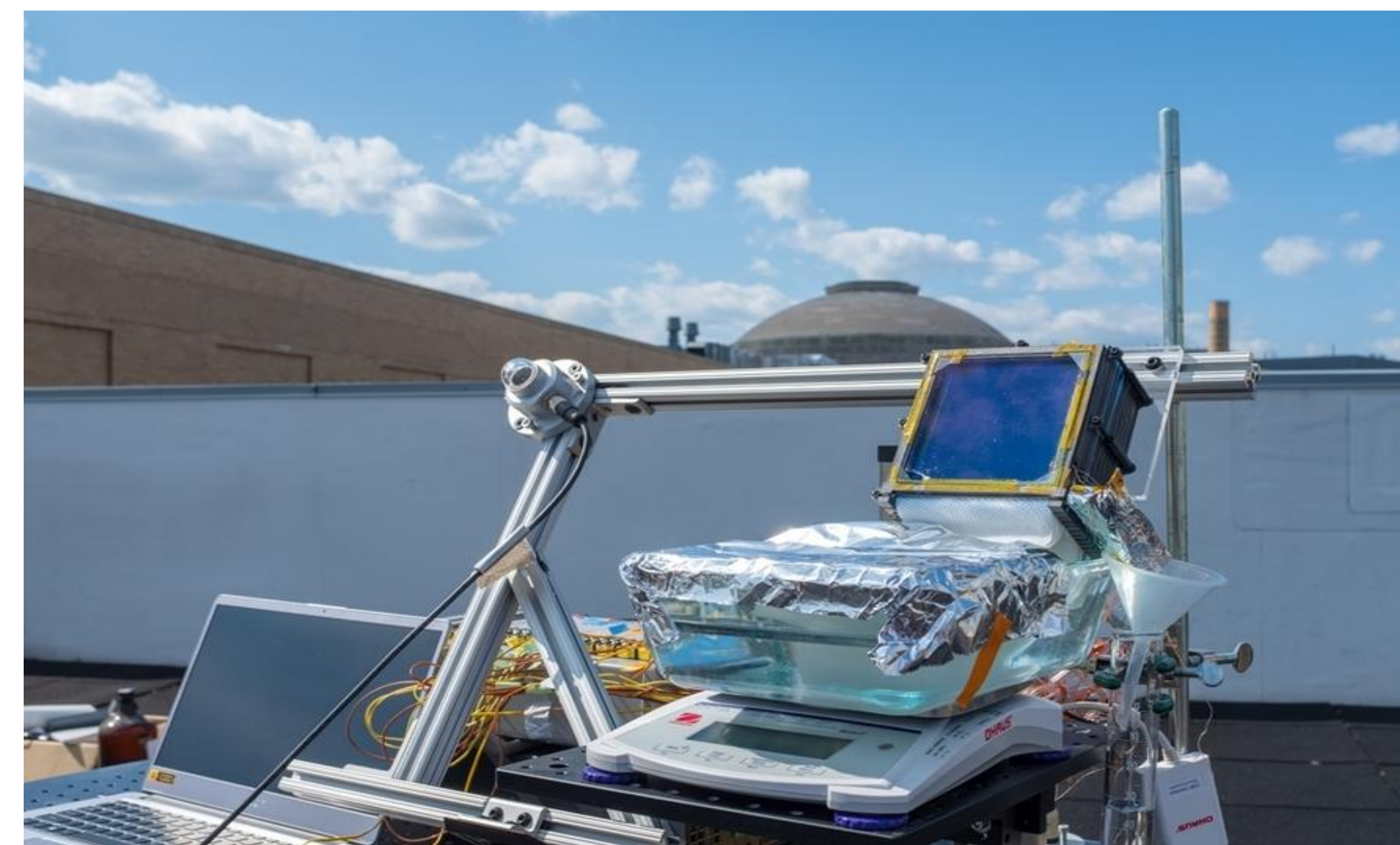
- The system works with ten stages of solar evaporators and condensers with the help of aerogel insulation ¹
- It has an efficiency of 385% of converting sunlight into water evaporation ¹
- Its flat panels absorb heat from the sun and transfers it to a layer of water to begin evaporating. The vapor is condensed on the next panel ¹
- It conserves energy since heat released by the condensation of water in the previous stage is used for the next one, instead of being lost to the environment ¹
- It can deliver pure water at a rate more than 1.5 gallons per hour per each square meter of solar collecting area ¹

□ The system functions similar to a simple solar still

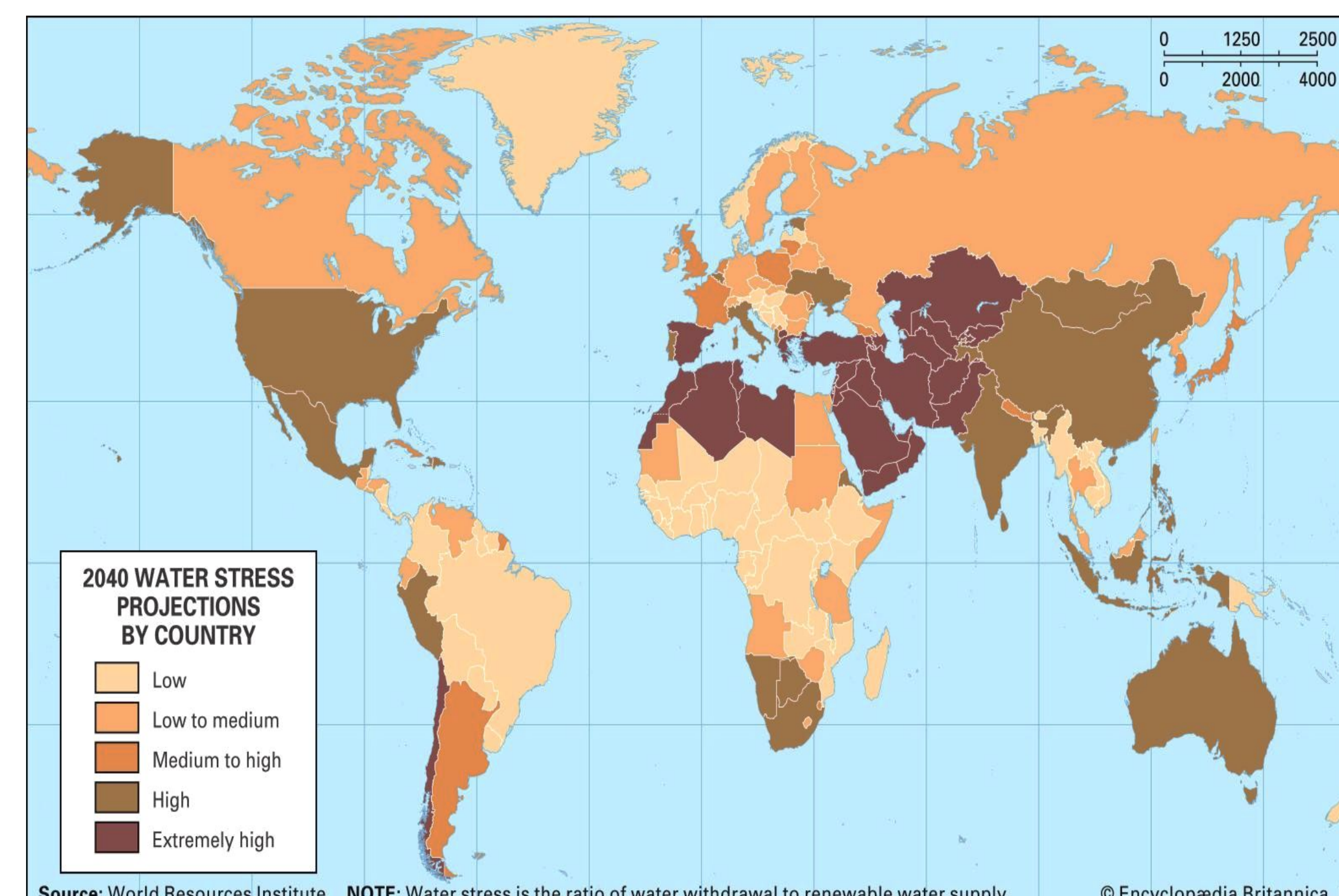


Key Points

- One of the main problems with desalination system is the accumulation of salt and salt brines that create waste ³
- This system's free-floating design results in the salt accumulated during the day being carried back out to the sea at night, eliminating the brine byproduct many desalination systems produce ¹
- It is extremely efficient because it recycles solar heat for the next stages ¹
- It is built with inexpensive materials, such as commercial black solar absorber and paper towels for a capillary wick ¹
- It also uses transparent aerogel as an insulator, which can be replaced with cheaper insulators to further lower the cost ¹



□ A proof-of-concept device built at MIT ¹



□ Water scarcity projection by 2040

Compared to Other Desalination Systems

- There are around 16,000 active desalination systems in the world, especially in arid regions, such as the Middle East ³
- Most desalination systems use energy-intensive processes, greater than 200 million kilowatt hours per day ⁴
- The energy costs also make up around 55% of the total operation costs ⁴
- Approximately, 51.8 billion cubic meters of brine is produced, every year by the existing desalination systems ³

Future Work

- The system could reach an efficiency of 700 to 800 percent with more stages and optimization ¹
- Their formulas can be adapted to different devices and materials, and configured to different scales of operation ¹
- A possible way to transport the clean water would be floating panels on a body of saltwater such as an impoundment pond. These could constantly and passively deliver fresh water through pipes to the shore, as long as the sun shines each day. ¹
- The system could also be designed to serve a single household, perhaps using a flat panel on a large shallow tank of seawater that is pumped or carried in. ¹

References

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