PV-Powered Desalination Systems

Potable and Agricultural Water Supply for Rural Villages

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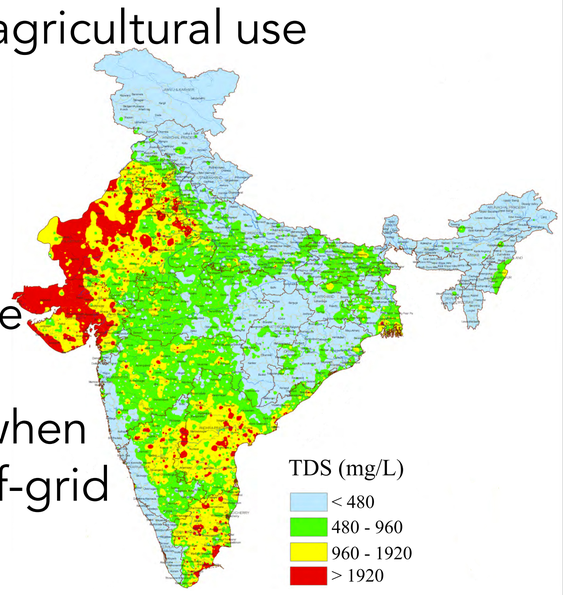
Opportunity

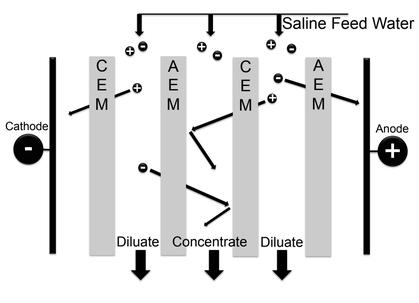
More than 70% of Indian villages use groundwater as their primary source of drinking water.[2] Groundwater has higher biological quality than surface water but contains higher levels of dissolved salts. Water with a salinity level greater than that recommended for drinking or agricultural use underlies 60% of India (right).[1] Current rural desalination systems become economically unsustainable when used with an off-grid power system.

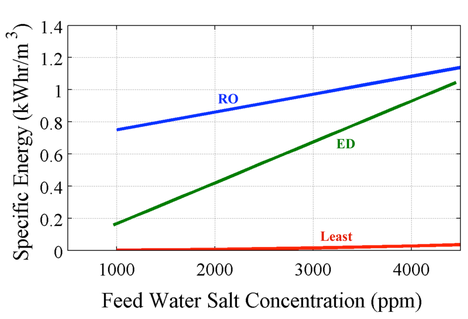


Proposed Solution: PV-EDR

The benefits of electrodialysis reversal (EDR) over traditional reverse osmosis (RO) systems include[3]:

- High recovery ratio (>90% vs. 40%)
- lower energy consumption per unit of water produced leading to lower capital cost (25-70% lower than RO)
- lower sensitivity to chlorine and feed water changes
- longer membrane life





Testing as part of the USAID Desal Prize:

USAID and Reclamation's Goal: "to incentivize the creation of an environmentally sustainable small-scale brackish water desalination system that can provide potable water for humans, as well as water appropriate for crops in developing countries."

August of 2014: Paper application submitted
December 2014: Selected as 1 of 8 semifinalist teams out of 68 original applicants
April 2015: Head-to-head competition in New Mexico (USA) consisting of two, 24-hour, test periods
May 2015: Received 1st place, $140,000 in prize money, and additional funds to complete pilot

Judged on:

- Adequate quantity and quality produced ($8m^3$ agricultural quality, $0.25m^3$ potable quality)
- High recovery
- Chemical addition
- Economic analysis
- Sustainable maintenance and service schemes

Conclusions and Next Steps

- System validated for technical performance in USA as part of Desal Prize
- Have received additional 1 million USD in funding beyond Tata Center at MIT
- Currently piloting two systems in India, with a third system in India and a fourth in Gaza planned
- Goal to beat the price of on-grid desalination systems, off-grid, expanding the reach of these systems to the half of the rural population who does not currently have access to the grid.

References

1. Central Ground Water Board Ministry of Water Resources (2010). GROUND WATER QUALITY IN SHALLOW AQUIFERS OF INDIA.
2. International Institute for Population Sciences (IIPS) and Macro International. National Family Health Survey (nfhs-3), 2005-2006: India: Volume I. Mumbai, 2007.
3. Natasha C. Wright, Amos G. Winter V., Justification for Community-Scale Photovoltaic-Powered Electrodialysis Desalination Systems for Inland Rural Villages in India. *Desalination*. Vol 23, 3 November 2014, Pages 82-91.

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