Competing in the Desal Prize & Piloting in Honduras

Presented by Malynda Cappelle
w/ information from MIT and UNT

Presented at
2016 Multi-State Salinity Coalition Annual Salinity Summit/28 January 2016

Overview

- What was the Desal Prize?
- Top 3 teams
  - 1st Place: MIT & Jain Irrigation Systems
  - 2nd Place: UTEP's Center for Inland Desalination Systems
  - Honorable Mention: University of North Texas (aka Green Desal)
- Achieving 95%+ recovery
  - Zero Discharge Desalination
  - Solar Salt Recovery
  - Photovoltaics
- Piloting in Honduras

The Desal Prize Concept & Partners

CIDS
Center for Inland Desalination Systems

- Goal: Enable environmentally sustainable small-scale brackish water desalination systems
- Requirements for competition:
  - Powered solely by renewable energy
  - High system recovery
  - Minimize environmental impact
  - Cost efficient, durable, and easy to maintain

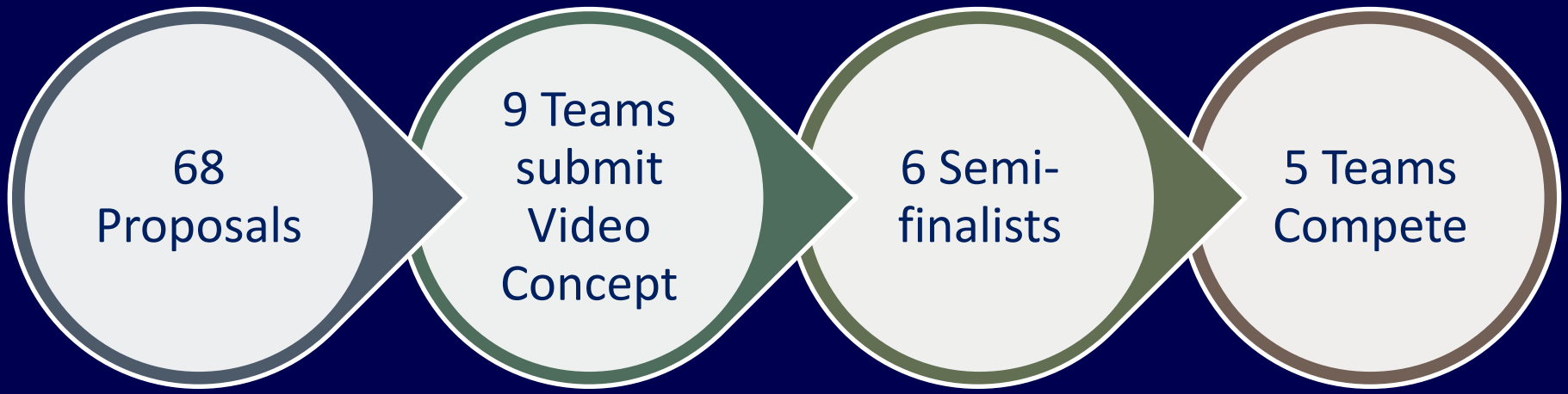
USAID
FROM THE AMERICAN PEOPLE

SWEDEN

Government of the Netherlands

RECLAMATION
Managing Water in the West

Path to the Desal Prize



The Desal Prize

Competition Details

Day 0: Equipment delivered, placed on pad

Day 1: Prototype assembly

Day 2: Prototype optimization, battery discharge, onsite presentations

Day 3: Competition

Day 4: Data Collection, Prototype optimization, battery discharge

Day 5: Competition

Day 6: Data Collection, pack

The Competition

Judging Metrics

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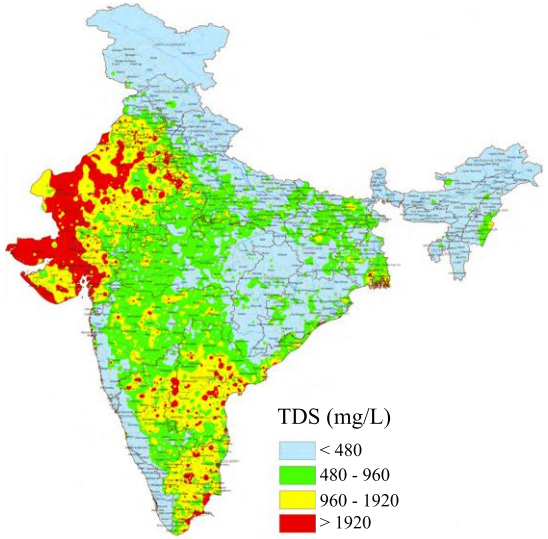
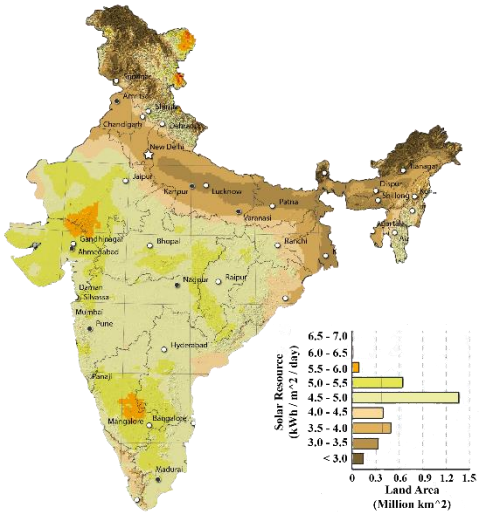
Performance Criteria	Scale	Weight
Technological Approach	Yes/No	--
Water Quantity & Water Quality	Yes/No	--
Powered Solely by Renewable Energy	Yes/No	--
System Water Recovery	1-4	30%
Chemical Treatment	1-4	15%
Concentrate Minimization/Concentrate Disposal Process	1-4	20%
Durability, Reliability, and Practicality	1-4	15%
Life Cycle Cost Analysis	1-4	20%

MIT : Photovoltaic Powered Electrodialysis Reversal





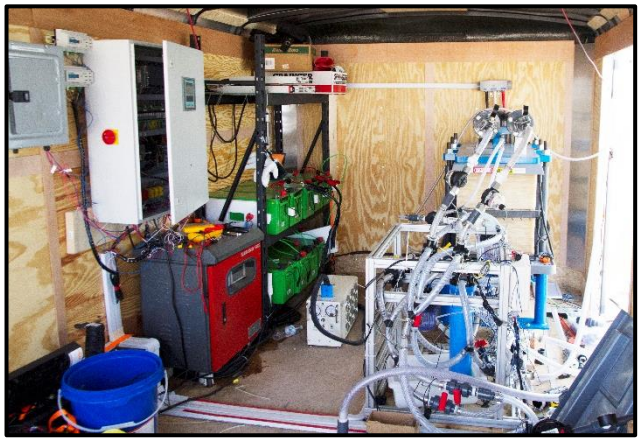
Motivation: 60% of Indian groundwater to saline to be used for potable or agricultural use, more than half the rural population without access to grid power

Partner: Jain Irrigation System, Ltd. – 2nd largest drip irrigation company in the work, 95% of business with < 5 acre farmers

Technology:

- PV-ED with combined batch/continuous operation, UV disinfection for potable supply
- 1.6 m^{3}/hr product flow rate
- 84% recovery achieved on day of competition

Pilots over next year: India and Gaza




GEAR LAB
JAIN
Irrigation Inc

GREENDESAL

Autonomous sustainable brackish desalination system for smallholder farming households

- Water treatment process based on proven technologies and smart use of available water
  - Reverse osmosis: high recovery ratio allows to generate the required amount of product water treating only 85% of the available raw water.
  - We use the remainder 15% to decrease salinity of the brines to that of brackish water which can be used
  - Ion exchange: to reduce the Ca^{2+} concentration in the water introduced to the RO system
  - Nano-filtration: to allow reuse of most of the regenerant (KCl) of the ion exchange process along with generation of $K^{+}/Mg^{2+}/Ca^{2+}$-rich fertilizer solution
- Electrical system
  - Hybrid wind/solar generation for off-grid applications offers flexibility
  - DC motors for pumping avoids DC/AC inverter
  - Control system options, PLC and low cost low power microcontrollers
- Potential brine usage: fertilizer, aquaculture, hydroponics
- Life Cycle Analysis: 2.44$/$m^3$ as an average of all 10 project years


GREENDESAL

UTEP's Approach (Honduras Pilot):
Achieving 95% Recovery

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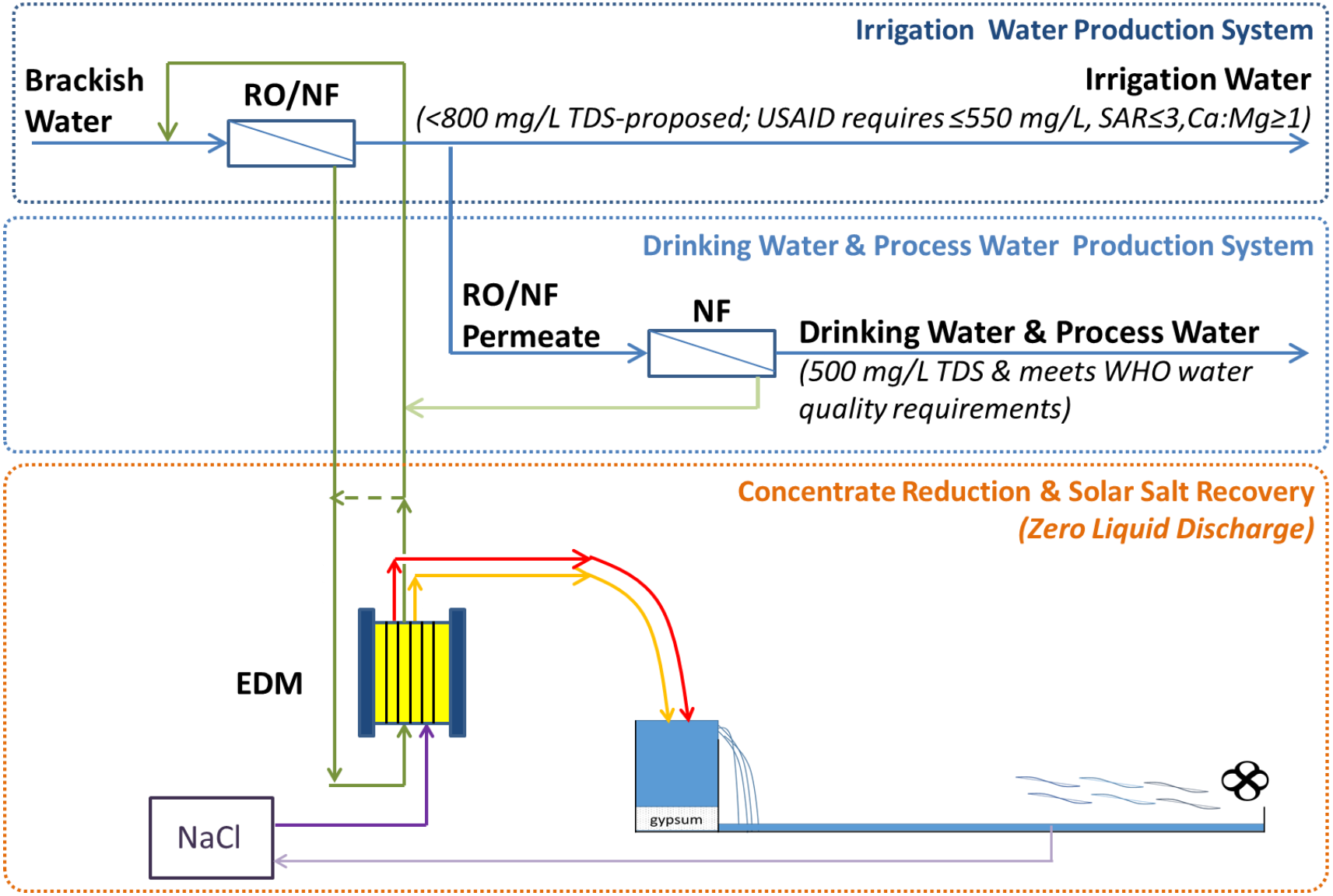
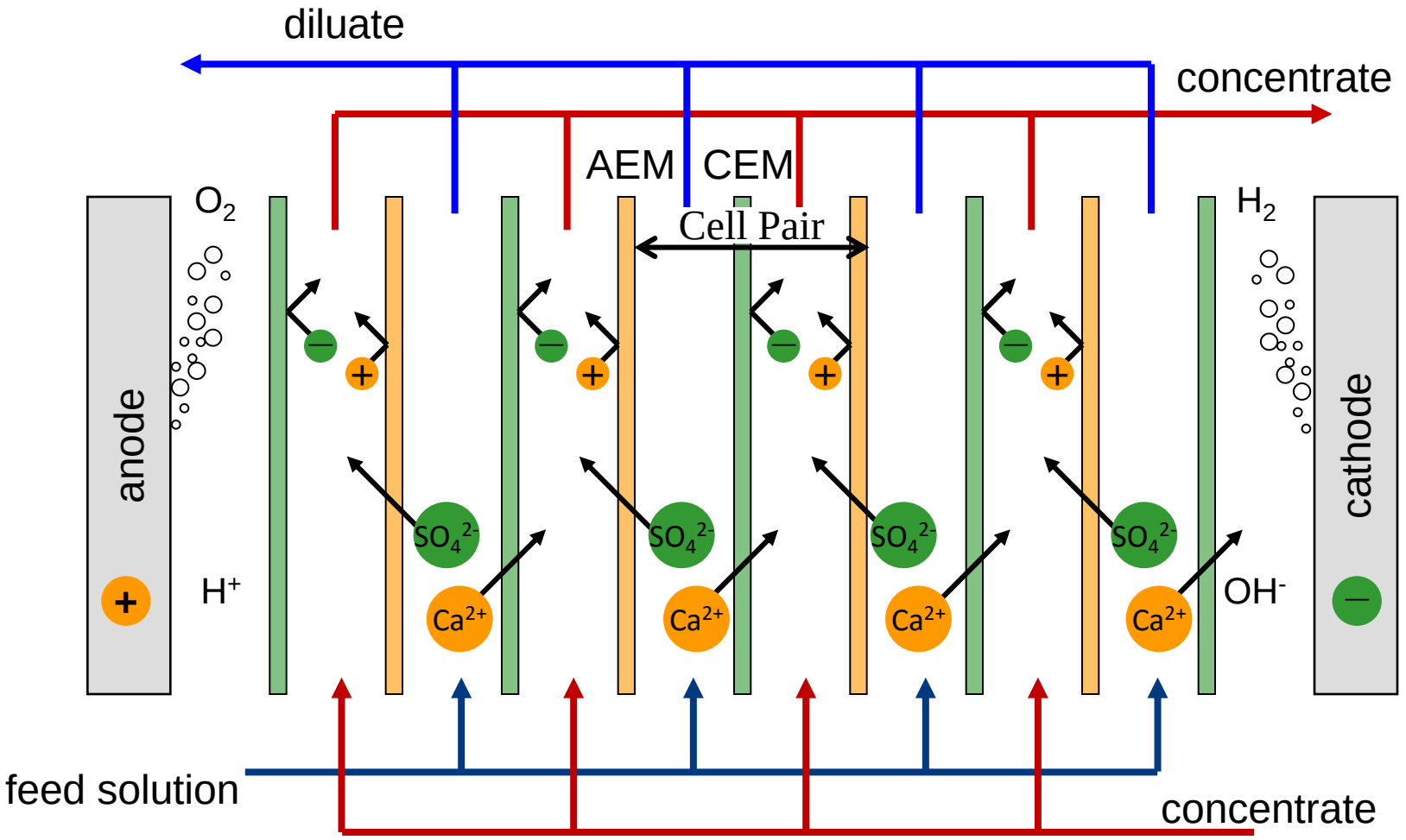
- Primary desalters:
  - NF for agricultural water
  - RO for drinking water (and/or process water)
- Secondary desalter/volume minimization
  - Electrodialysis metathesis (EDM) desalinates NF/RO concentrate
- Solar Salt Recovery & Enhanced Evaporation
- Photovoltaic System

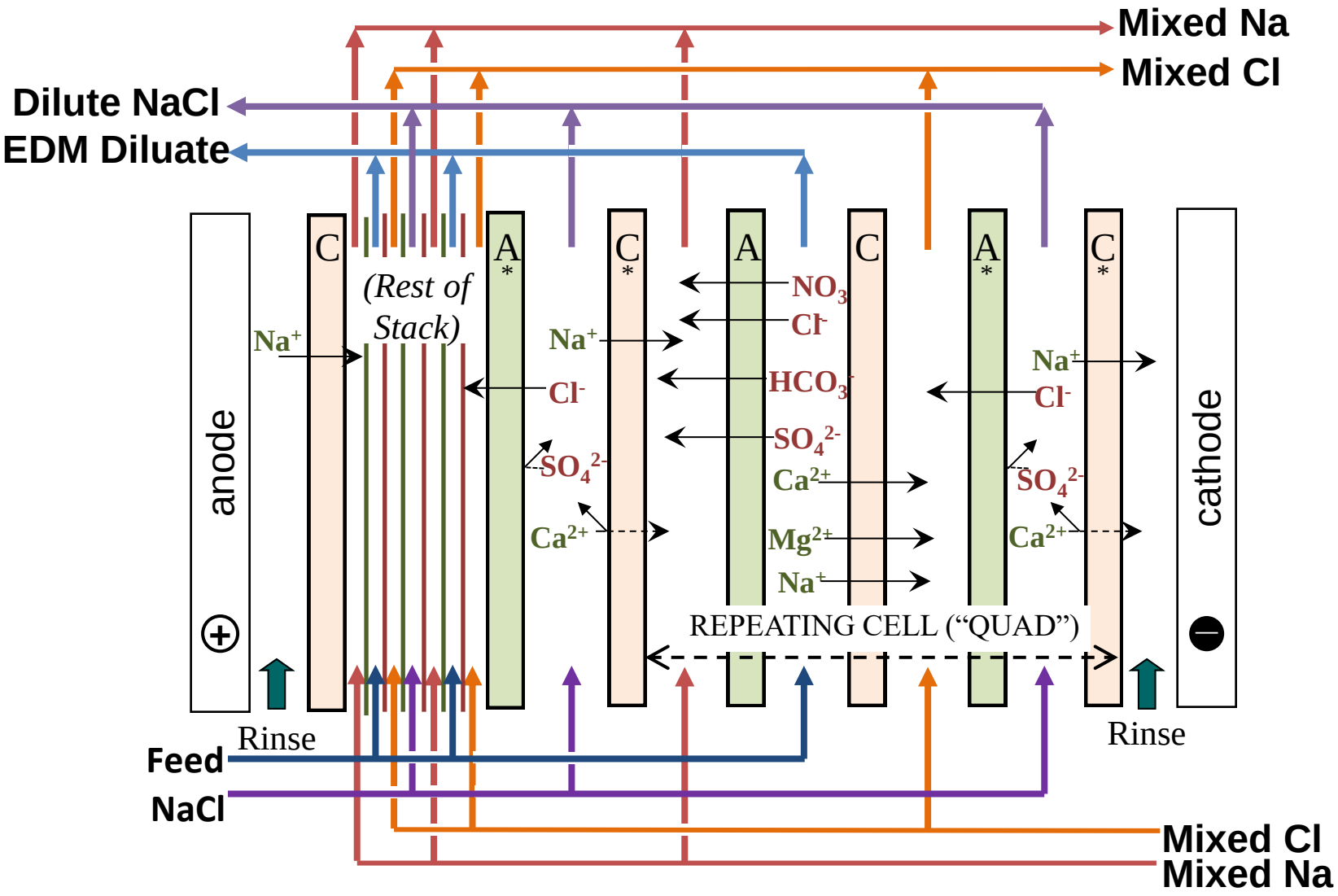
ZDD w/Solar Salt Recovery



Calcium sulfate is problematic for electrodialysis (ED)



EDM: Switching Partners & Exploiting Solubility



Photovoltaic System (10 kW)

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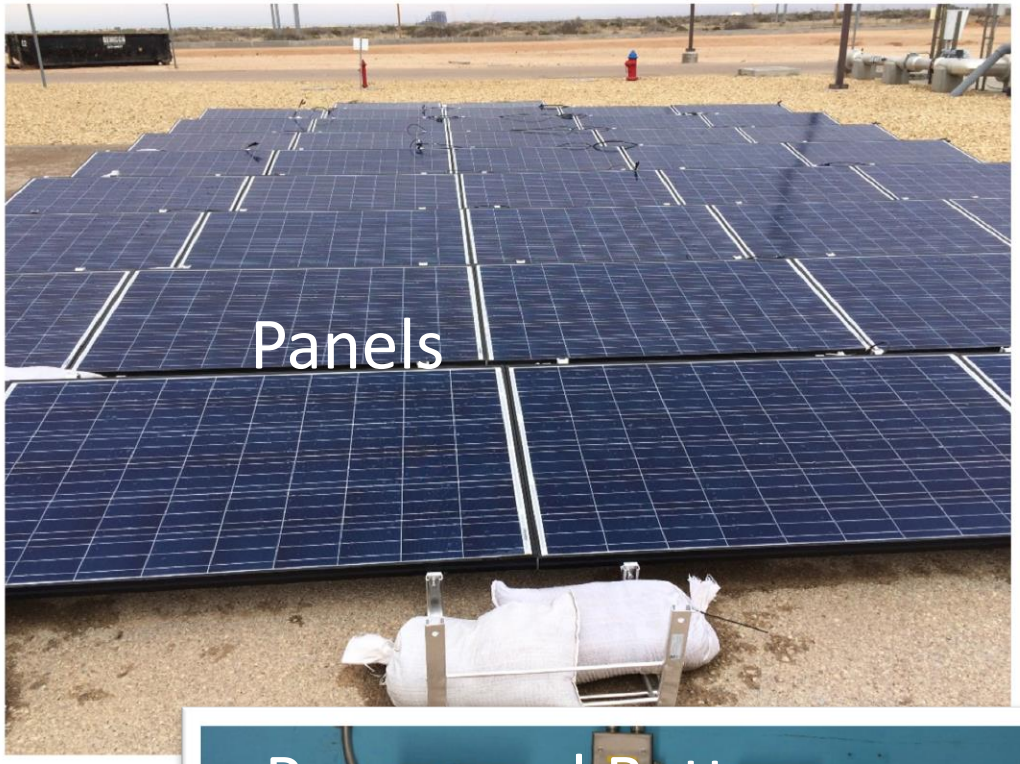

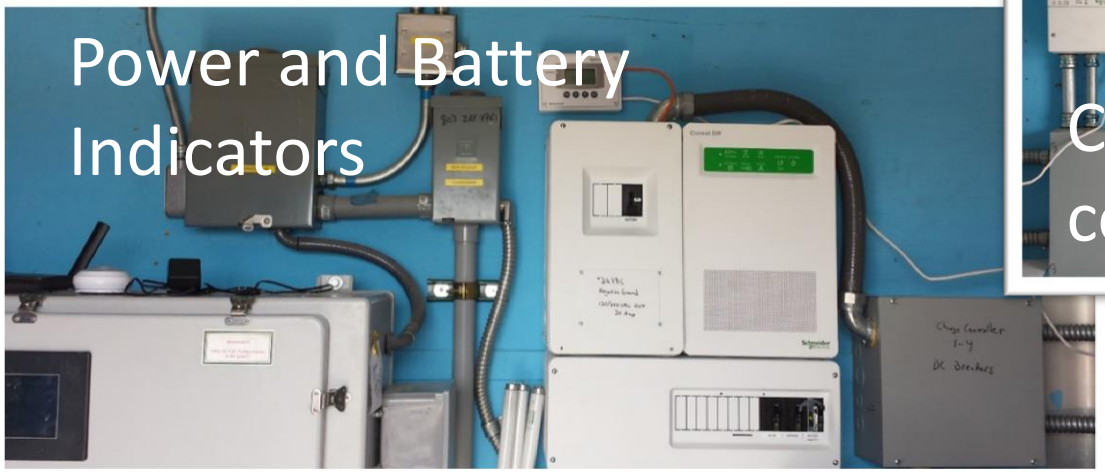

What's Next?

Pilot in Honduras

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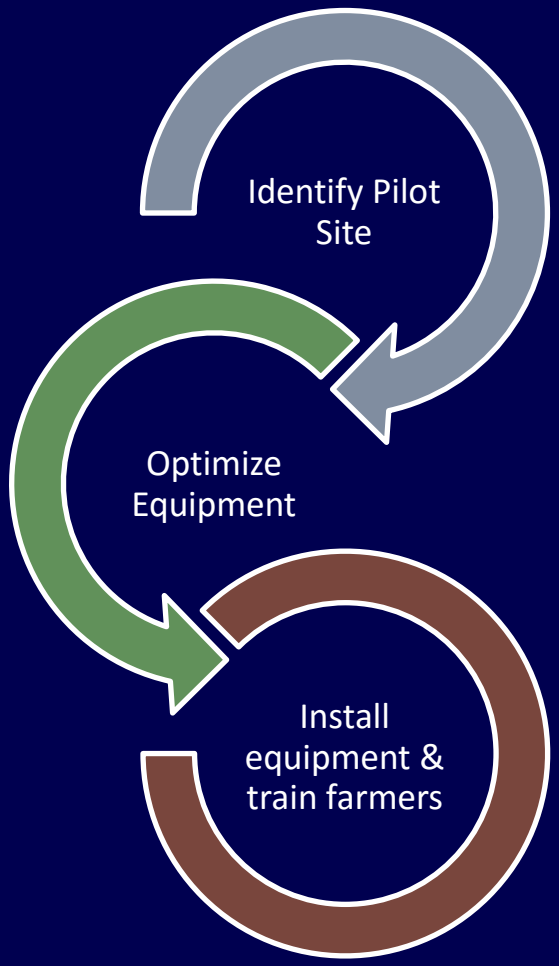
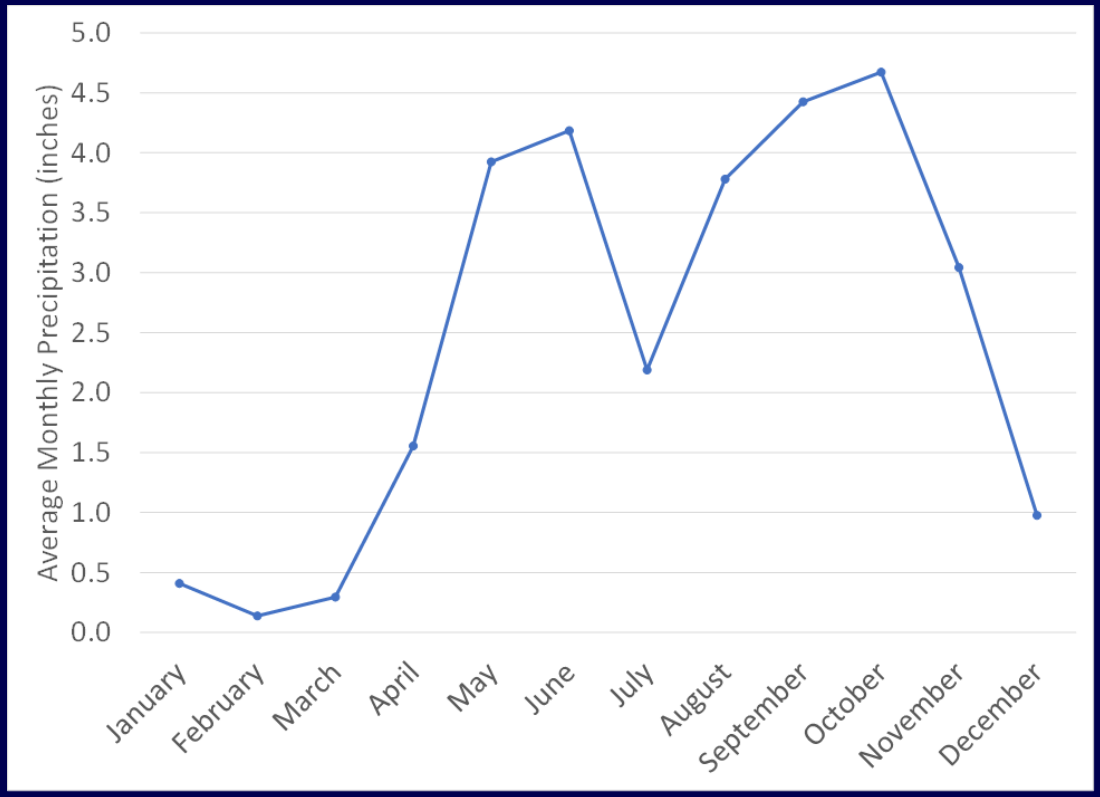


Average Rainfall (Tegucigalpa, Honduras)



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Sanaa El Agua... Un Derecho Humano

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El Paso Times

Monday, April 6, 2015 $1.00 FACEBOOK.COM/EPTIMES TWITTER.COM/ELPASOTIMES elpasotimes.com

WATER

VITAL RESOURCE

Desal Prize: Team of UTEP engineering students is among 5 finalists in global competition

Desalination: Project goal is to transform salt water to clean, fresh water using solar power

Malynda Capelle and Tom Davis show the UTEP Center for Inland Desalination Systems zero discha competition.

By Ramon Renteria

A University of Texas at El Paso team of engineering students will spend this week in Alamogordo competing with some of the nation's brightest minds, scrambling for solutions to one of the world's most pressing problems — the growing scarcity of water to drink and grow food.

UTEP's team is among five finalists selected from 79 applicants in 29 countries to compete for the Desal Prize, a global competition looking for game-changing solutions as well as the most efficient innovations that can produce water suitable for humans plus water appropriate for crops.

The goal is to transform salt water into clean water using only renewable energy — solar power in UTEP's case.

The payoff: the top three contenders advance to the next level of competition and share $200,000 in prize money to further refine their inventions and research.

"We've tested this technology in many places and we're looking forward to testing it in the Desal Prize," said Malynda Cappelle, associate direct UTEP's Center for Inland D ination Systems. "This is a dar us to some day comme ize the technology and get there."

USAID Global Develop Lab's Securing Water for initiative designed the co thon taking place throug urday at the Brackish Gro water National Desalinatio search Facility in Alamog

The competition's winne produce a machine that solely on renewable energy duces no more than 15 per

RESOURCE » B

IRON KNIGHTS

Ebola mission a 'big-time success'

By David Burge

FORT BLISS » The mission to help combat the deadly Ebola virus in West Africa was a smashing success and Fort Bliss played a crucial role in it, said the commander of the Army aviation task force that served in Liberia.

"Liberia is now nearly Ebola-free," said Lt. Col. Whitney R. Gardner, commander of Fort Bliss' 2nd Battalion, 501st Aviation Regiment and head of the Army aviation task force that provided transportation and logistical support during the Ebola-containment mission known as Operation United Assistance.

APRIL 26-MAY 2, 2015 SECTION C

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GECU

Helen of Troy $79.16 ▼0.16 -0.2% (WK) 1.4% (MO) 21.7% (YTD)

W $47.03 ▲3.72 8.6% (WK) 1.4% (MO) 24.5% (YTD)

UTEP team second in Desal Prize

From left: Tom Davis, Malynda Cappelle and Shane Walker

Photo provided by UTEP University Communications/JR Hernandez

A team from UTEP's Center for Inland Desalination Systems took second place in the international Desal Prize competition, winning $60,000.

First place and the $100,000 went to a team from the Massachusetts Institute of Technology.

The competition, hosted by the U.S. Agency for International Development, asked entrants to create cost-effective, energy efficient and environmentally sustainable ways to turn brackish water safe for drinking water.

The prototypes were tested and evaluated by judges at the U.S. Bureau of Reclamation's Brackish Groundwater National Desalination Research Facility in Alamogordo, New Mexico.

Members of the UTEP are Tom Davis, director of the Center for Inland Desalination Systems, associate director Malynda Cappelle and Shane Walker, assistant professor of civil engineering.

The team is now eligible for up to $400,000 in grants to put their prototype in USAID pilot projects.

"I look forward to the next step, which will be piloting our system with farmers in a developing country hopefully somewhere in Latin America," said Cappelle.

CIDS

Center for Inland Desalination Systems

Our Team

- Dr. Tom Davis
- Dr. Shane Walker
- Malynda Cappelle
- Main Students: Lisa Haisan, Paulo Araujo, Jesus Placencia, Isadora Araujo, Gustavo Puaitti, Osvaldo Broesicke

Thanks for listening!

Malynda Cappelle

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