Managing Salt: Creating Value from High Salinity Water Sources

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Erik Hanson
Director, Product Management & Strategy
SUEZ Water Technologies & Solutions

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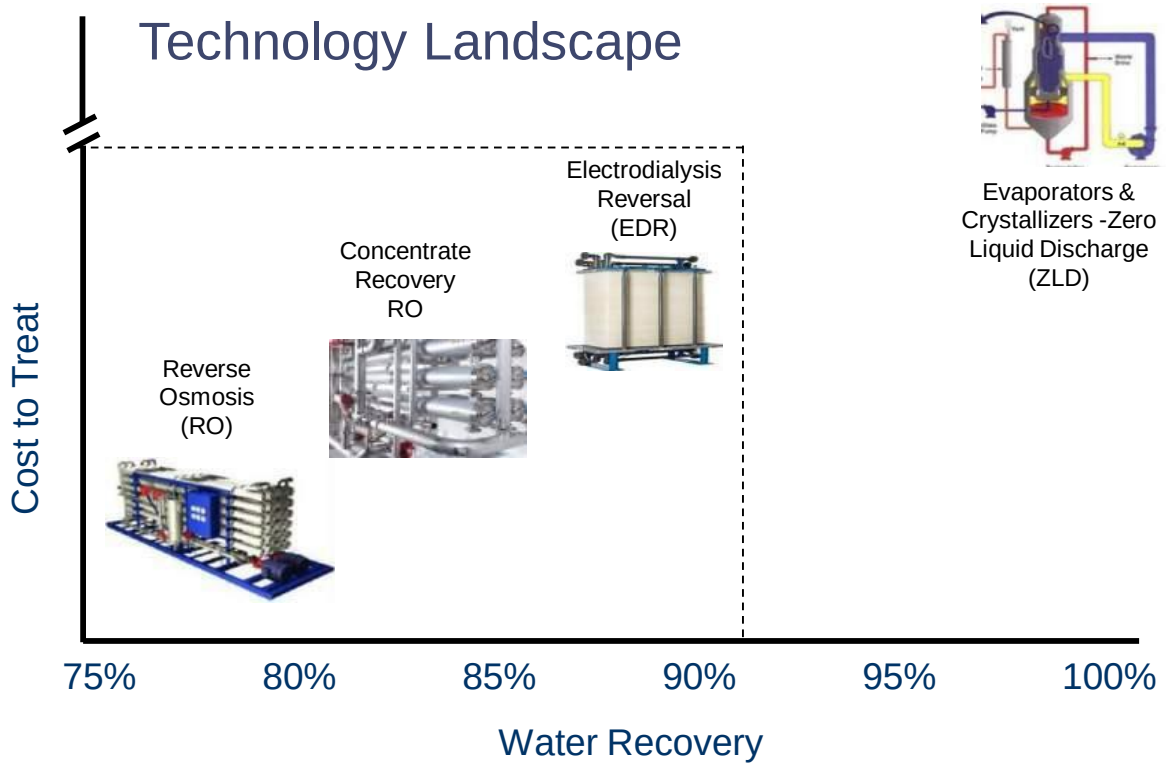
Managing Salt: Creating Value from High Salinity Water Sources

Abstract
This presentation focuses on technologies and unique process flow arrangements to turn high salinity feed water into useable, valuable feed streams. It includes a technology overview of Electrodialysis, with emphasis on Electrodialysis Reversal (EDR), and a case study demonstrating its advantage on water sources requiring salinity management. Also addressed is a novel method for increasing the output of seawater desalination plants by using Electrodialysis and high salinity streams.

Agenda
- Salinity Reduction Technologies
- What is Electrodialysis?
- EDR Case Study: Drinking Water
- Reverse Electrodialysis (a.k.a. RED)
- Future of EDR

Salinity Management Technologies



Evaporators & Crystallizers -Zero Liquid Discharge (ZLD)

Deciding Factors: Chemistry, Price, & Footprint

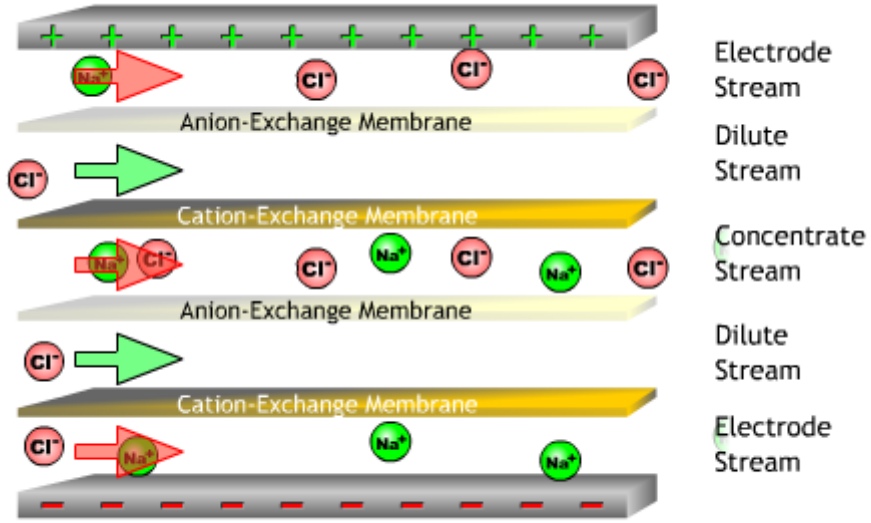
Electrodialysis

- Electrically Driven Technologies
- Used in salinity reduction & other separations for high recovery challenging water sources

RO and NF

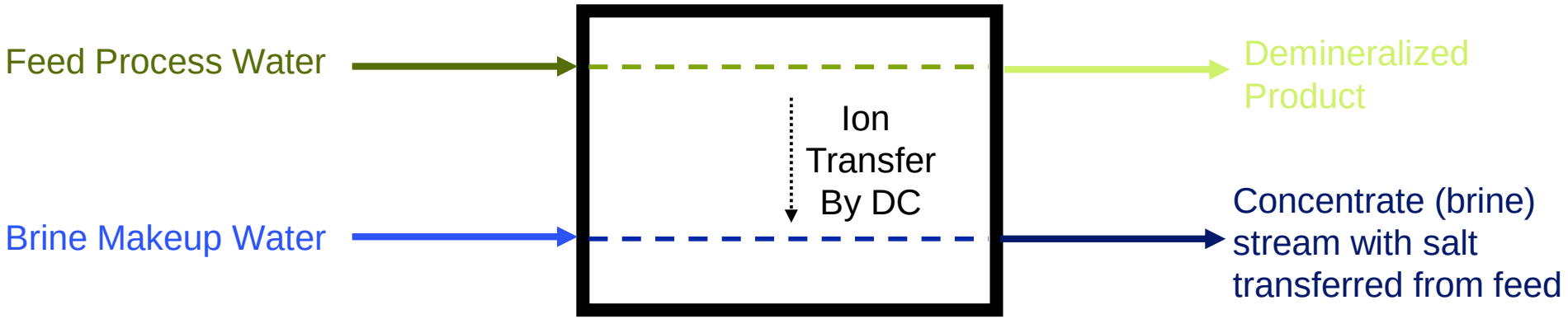
- Pressure Driven Technologies
- Widely used in salinity reduction and other separations

What is Electrodialysis?



It is a plate-and-frame ion exchanger.

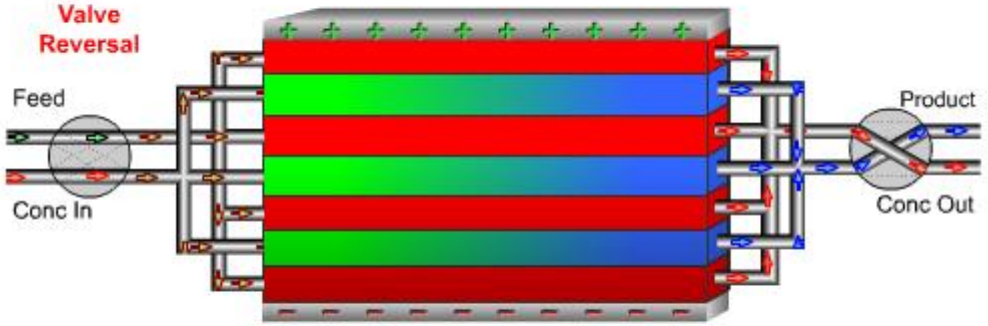
Electrodialysis removes ions and leaves **valued product** behind.



Electrodialysis Reversal (EDR) addresses scaling and fouling

Critical difference between ED and EDR: addressing scaling and fouling issues with regular polarity reversal

- System reverses 3 to 4 times per hour
- Minimizes need for continuous chemical feeds
- Helps remove organics that may have settled on membrane surface



Electrodialysis removes the salt… polarity reversal keeps it clean of scale and organics

Why do these difference matter and who benefits?

Advantages of EDR

- 40 - 60% salt removal per stage
- salt reduction of ~ 90% is practical upper limit, usually done in 2 or 3 stages
- Water recoveries of 85 to 94% are typical
- Removes ionized species at operating pH
- No silica rejection or concentration
- Robust operation… can take apart and manually clean if upsets happen

Applications taking advantage of EDR benefits

- Drinking Water
  - High recovery ideal for water scarce locations
  - High silica or high organics don't impact as much as on RO or NF
- Wastewater for irrigation or for meeting discharge limits
  - Chlorine residual for biogrowth control
  - Alleviates stresses on fresh water for irrigation
- Industrial process water and wastewater

EDR Case Study

California Army Base

Customer's Situation

- 6 MGD drinking water required for army base in remote area
- Highly variable feed water (blending from 12 wells!)
- High levels of silica in wells, limiting RO recovery to ~ 55%
- No means of disposal… waste goes to evaporation ponds

Options:

- RO… silica scale limited water recovery to 55%... too much discharge
- ZLD or near ZLD… good for lack of disposal, but $$$
- EDR… unaffected by silica concentration, able to achieve 92% water recovery

✓ EDR System selected for 6 MGD consistent drinking water supply

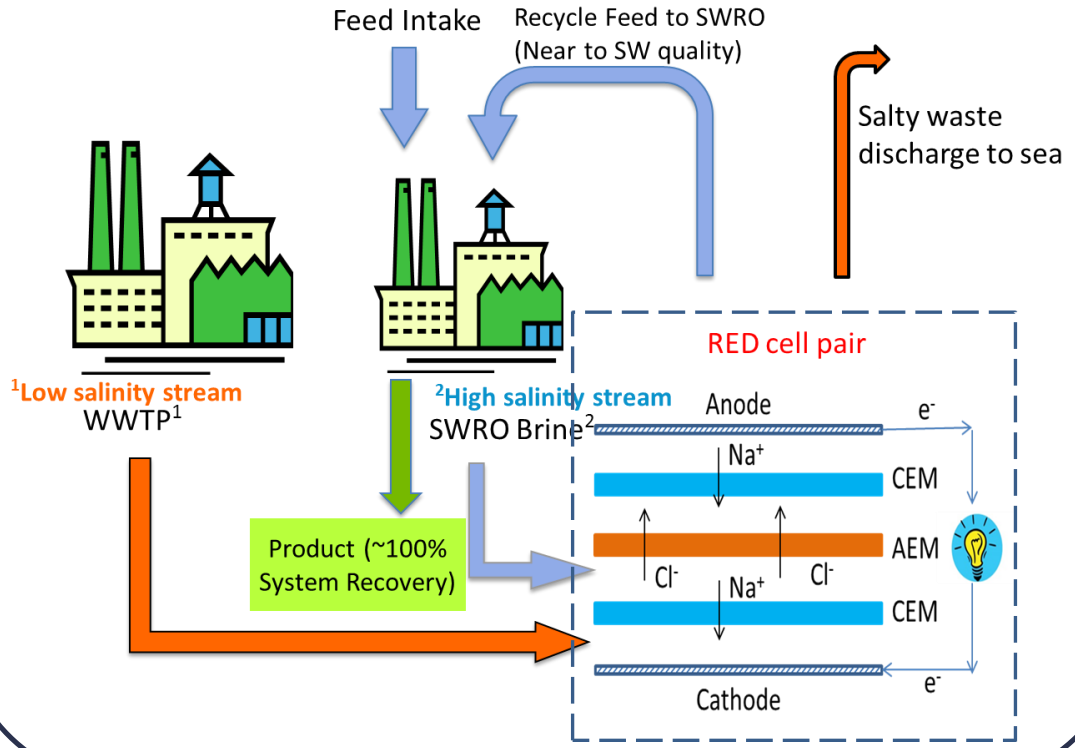
✓ Removing arsenic, fluoride, & nitrate at > 92% water recovery

Reverse Electrodialysis (RED)

A novel method of increasing capacity of desal plants

Reverse Electrodialysis (RED)

RED Process for Seawater Desal plant expansion



Benefits of RED for Seawater Desalination

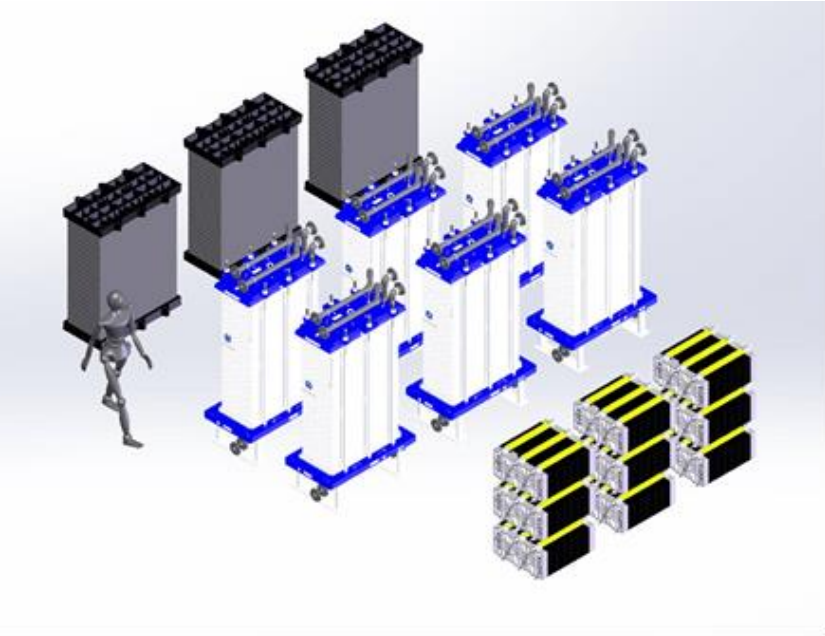
- Higher SWRO recovery, reduced cost of water
- Lower energy consumption
- Environmental benefits:
  - Less seawater taken from the ocean, less impact on marine life
  - Less discharge and discharge salinity close to seawater

Where should RED be considered?

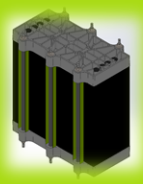
- New or expanding SWRO plants
- Located <15 km from existing WWTPs or other medium salinity sources

Next Generation EDR… Coming Soon!

Next Generation EDR… Coming Soon!



EDR
today



Next Gen EDR
(2019 launch)

New & Improved EDR

- Modular & modernized design for easy design, install, and commissioning
- User friendly, online design software for end users, consultants, and EPCs
- Configurable system design with material, instrumentation, & controls options
- Lower price per gallon than historical EDR system solutions
- Same robust capabilities and silica passage as always

Thank You