

INNOVATE NEW MEXICO® TECHNOLOGY SHOWCASE

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INNOVATE NEW MEXICO®
Discover *The State of Innovation*



Low-energy, chlorine-tolerant desalination membranes

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RESEARCHERS AND FUNDING

Dr. Laura Biedermann



Desalination membranes

Dr. Michael Hibbs



Polymer chemistry

Dr. Curtis Mowry



Analytical chemistry

Funding to date:

LDRD (Sandia)

\$50k, FY14

\$1.5M, FY16-FY18

EPRI Seeding

\$60k, FY16-FY17



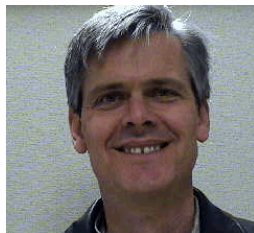
ELECTRIC POWER RESEARCH INSTITUTE

Mr. Michael Hightower



Energy-Water nexus

Dr. Kevin Zavadil



Battery electrochemistry

Dr. Trey Pinon

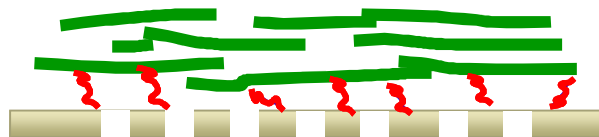


Polymer mechanics



THE INNOVATION

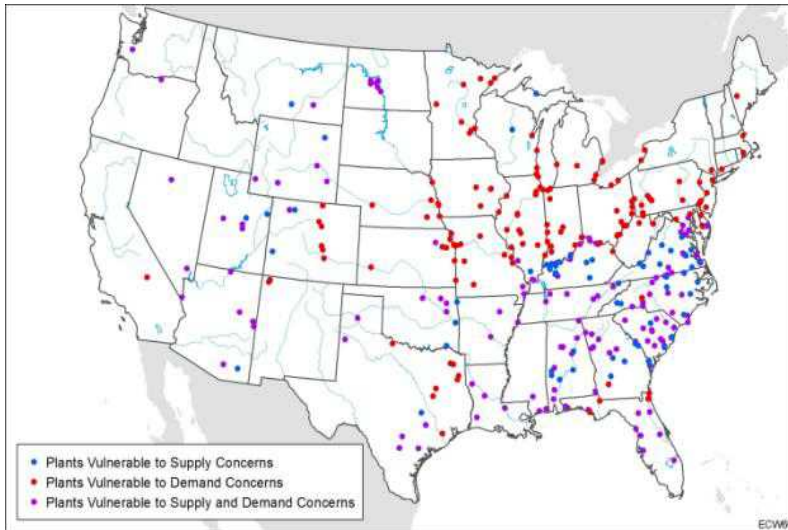
This new technology improves desalination at a lower energy and operational cost



Laminar graphene oxide, covalent linker molecules and porous polymer support provide ion rejection, membrane integrity, and mechanical durability

BACKGROUND

Energy and water are inextricably linked



Coal power plants vulnerable to water supply stress and water competition

- vulnerable to supply concerns
- vulnerable to demand concerns
- vulnerable to supply and demand concerns



BACKGROUND

Energy and water are inextricably linked

Power plant vulnerability



Diversify water supplies
Recycle blowdown water



Desalination

Existing reverse osmosis, < 0.1 ppm

ABQ water

DC water



Typical municipal chlorination levels (ppm)

0 ppm

1 ppm

2 ppm

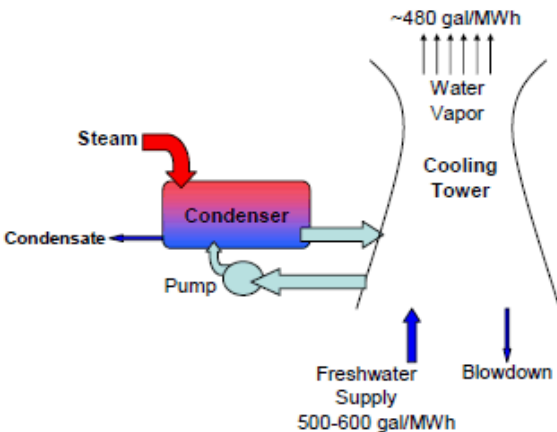
3 ppm

4 ppm

Biofilms (bacteria) rapidly grow in dechlorinated feed water

APPLICATION

Thermoelectric power plants are optimum proving ground



Water challenges: Energy use, permeance

- Keep divalent ion loads <100 mg/L
- Minimize biofouling with low-level chlorination

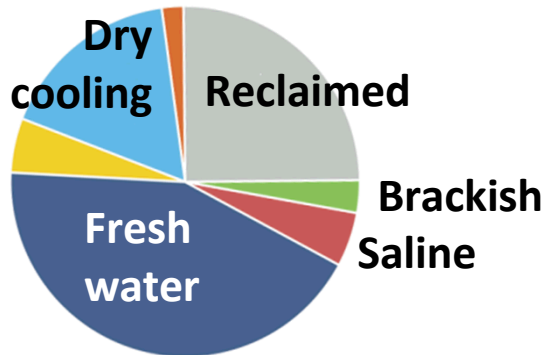
DoD requires direct-potable reuse and energy-water microgrids

NEED/MARKET POTENTIAL

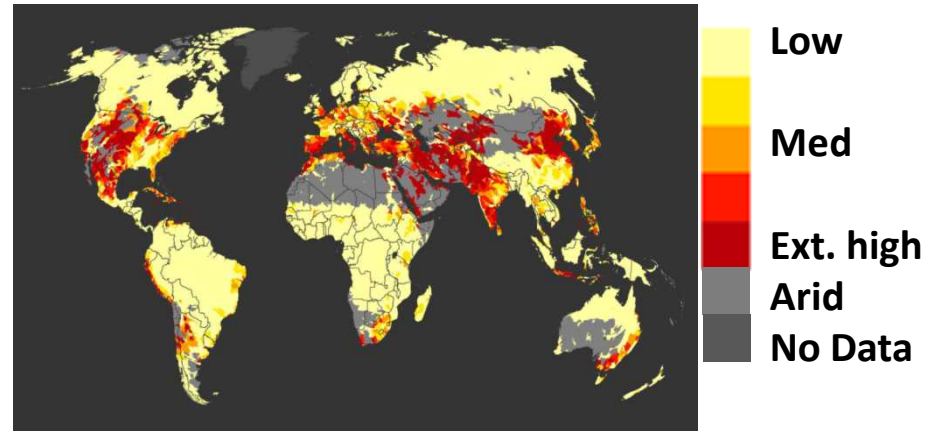
“Water resource scarcity, variability and uncertainty are impacting energy systems in the U.S. and China,” *Secretary Moniz.*

9 billion gallons/day (BGD) freshwater is **consumed** for thermoelectric power (2010)

Proposed power plants' cooling systems¹

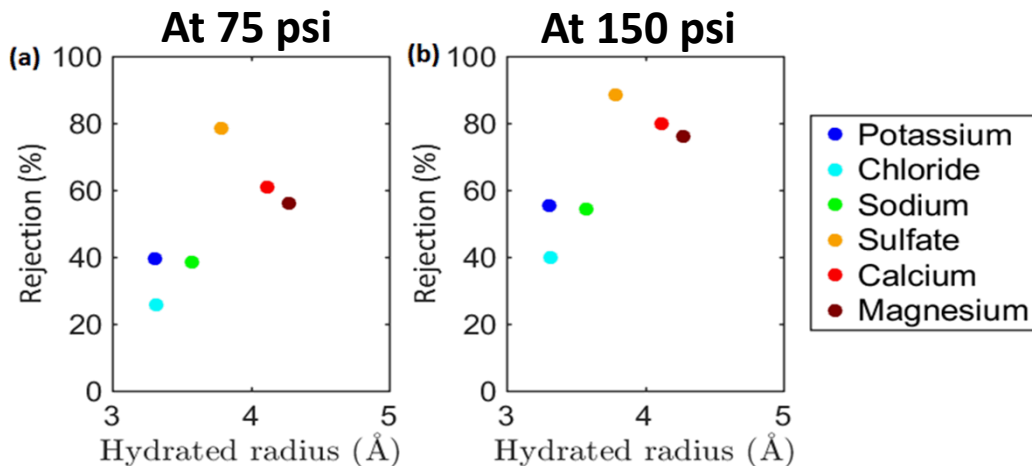


Baseline Water Stress (1950-2010)



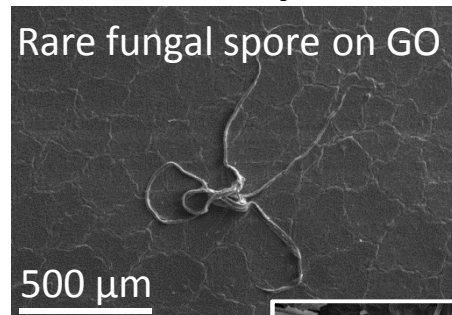
DATA AND RESULTS

Match customer's needs with pressure-tunable rejection

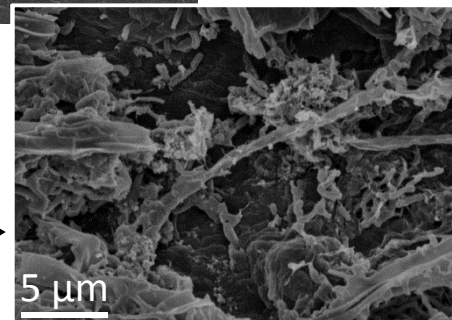


>80% rejection of scale-forming divalent ions, even after dosing to 1 ppm bleach

Biofouling-resistant: GO is naturally anti-microbial.



Spore growth on PVC tubing

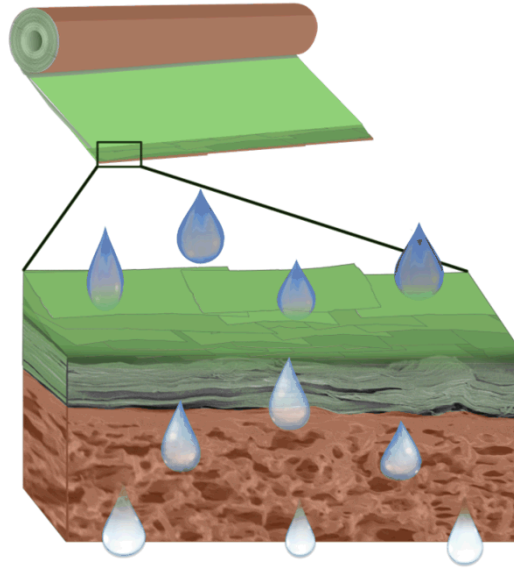




CURRENT STATUS



2"x4" GO/polymer membranes
Month-long desalination tests
show stable rejection



**Seeking partnership with
polymer manufacturer to
develop roll-to-roll
manufacturing**