



From Lab to Tap: How Advanced Tech is Solving Local Water Challenges

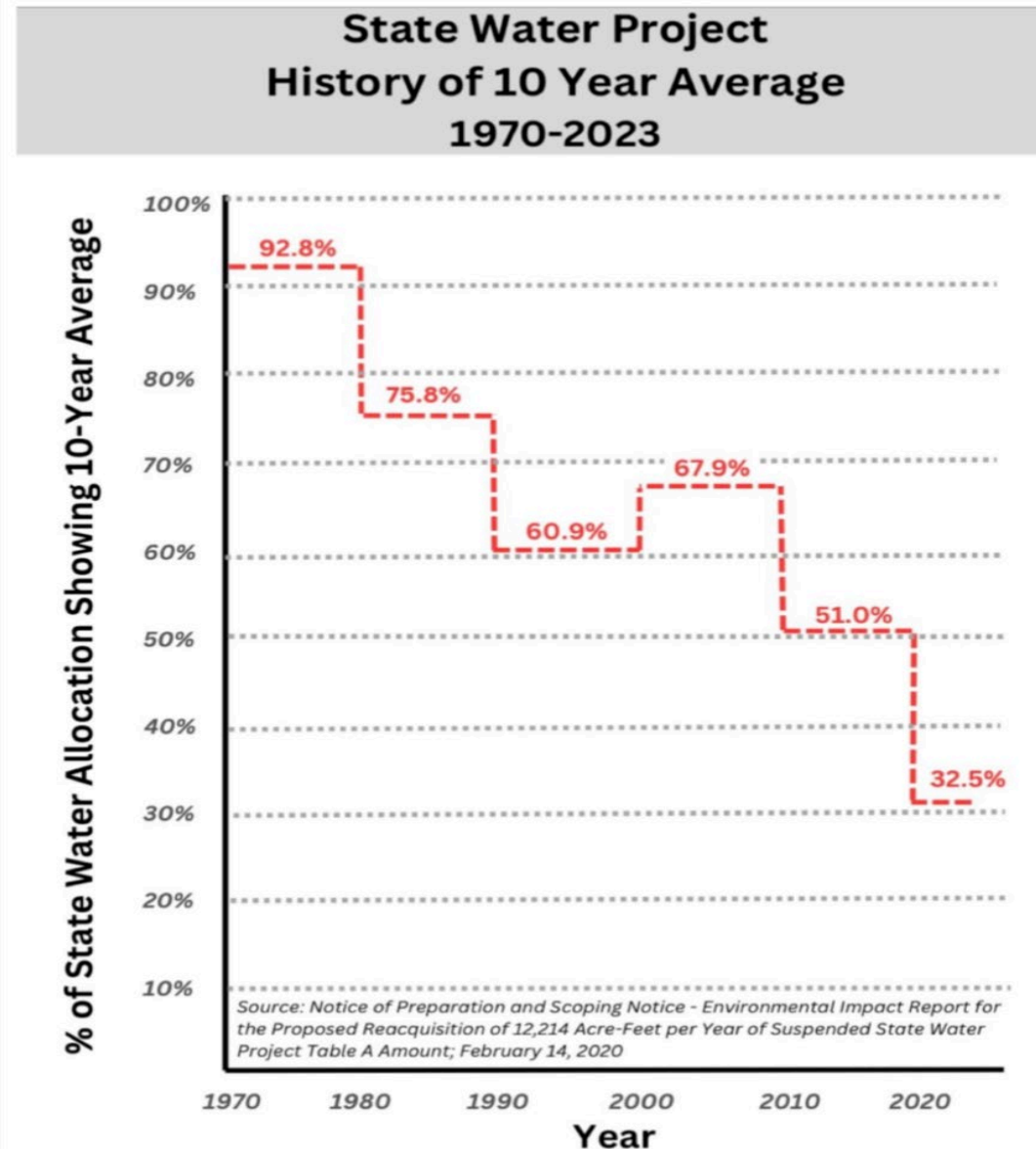
Floyd Wicks
Region 5 Board Member

California's urgent need for innovative water solutions

Is what we've been doing working?

How about a new approach?

How about something innovative?



Where can we get more water?

No more low-hanging fruit

- Produced water from Oil Wells
- Ocean Water
- Brackish Water
- Contaminated Groundwater
- Direct Potable Reuse of Wastewater

How do we deal with the problems?

- Contaminants in feedstocks
- Residual contaminants in produced water from oil wells
- Expensive treatment trains
- High TDS
- High energy costs
- Higher overall costs
- Membrane Fouling

Could a biologist or a biochemist duplicate what plants do?

- Plants and animals purify and move water at low energy easily, reliably, “cheaply.”
- What if we could:
 - achieve “the Holy Grail of separation science” - low energy with high specificity
 - Use tech to function like a kidney: keep what’s vital to life and dismiss the rest
 - perform better than the Aquaporin “water superhighway”
 - be non-fouling like a blood vessel
- Could tech deliver Nature’s benefits: low energy, low cost, no chemicals, no pre-treatments, high purity, anti-fouling, small footprint?

Following Nature's path to producing precision water

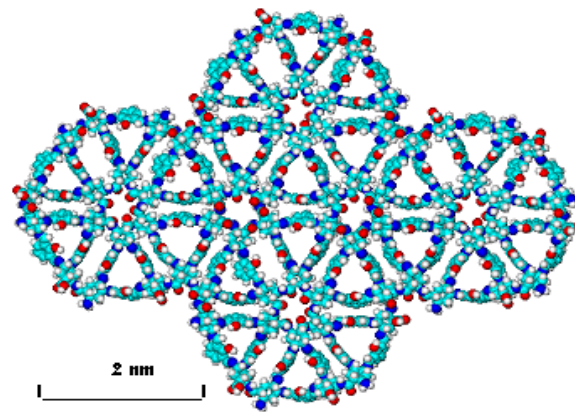
Agua: water Via: path



Department of Energy Grants: *Ultra Low Energy, Low Cost Industrial Nanomembrane Manufacturing for Desalination, Water Purification, and Remediation*

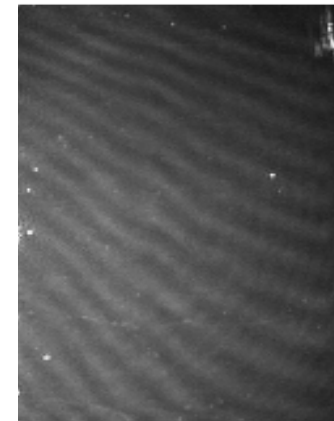


How do you manufacture a 1-atomic-layer-thick membrane?



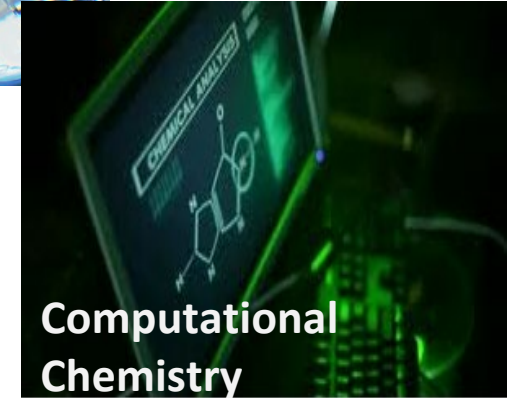
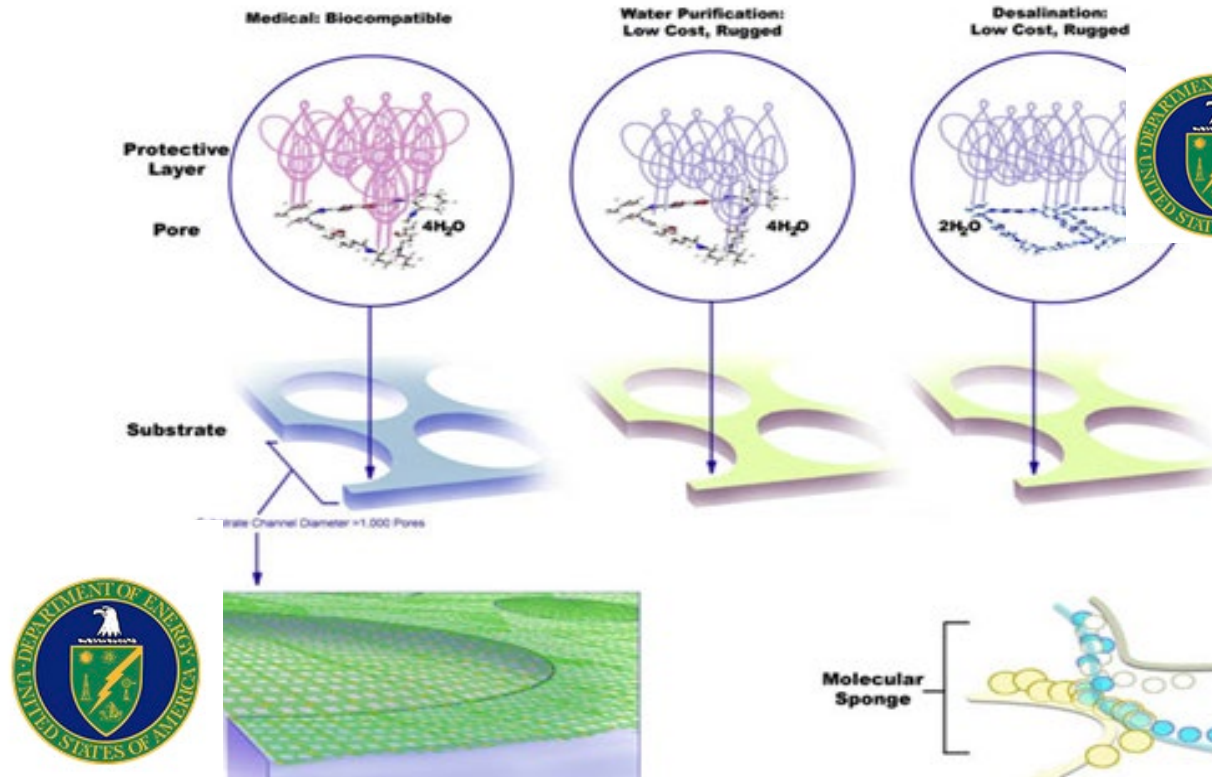
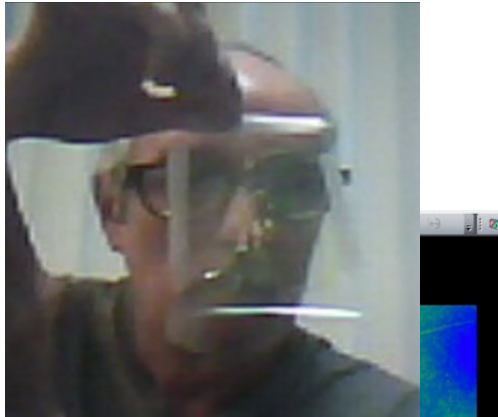
National Science Foundation
WHERE DISCOVERIES BEGIN

National Science Foundation
Grant: *Manufacturing Nanomembranes for Water Applications – In Process Analysis*

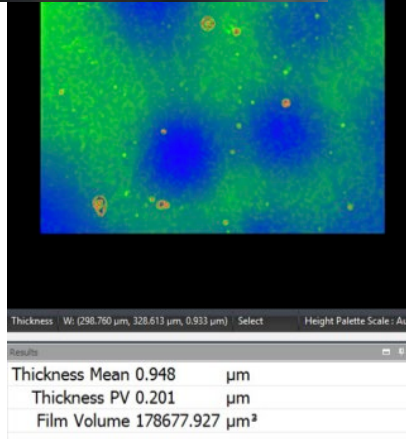


How do you track quality manufacturing for a 1-atomic-layer-thick membrane?

Department of Energy grants to cut costs, speed desalination

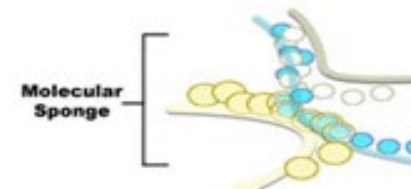


DOE grant – develop a water-only pore. Desal.



Thickness Mean	0.948	μm
Thickness PV	0.201	μm
Film Volume	178677.927	μm ³

DOE grant to reduce the cost on the substrate, the most expensive component



DOE grant to develop unique Forward Osmosis



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ENERGY

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Energy Efficiency &
Renewable Energy

ADVANCED MANUFACTURING OFFICE

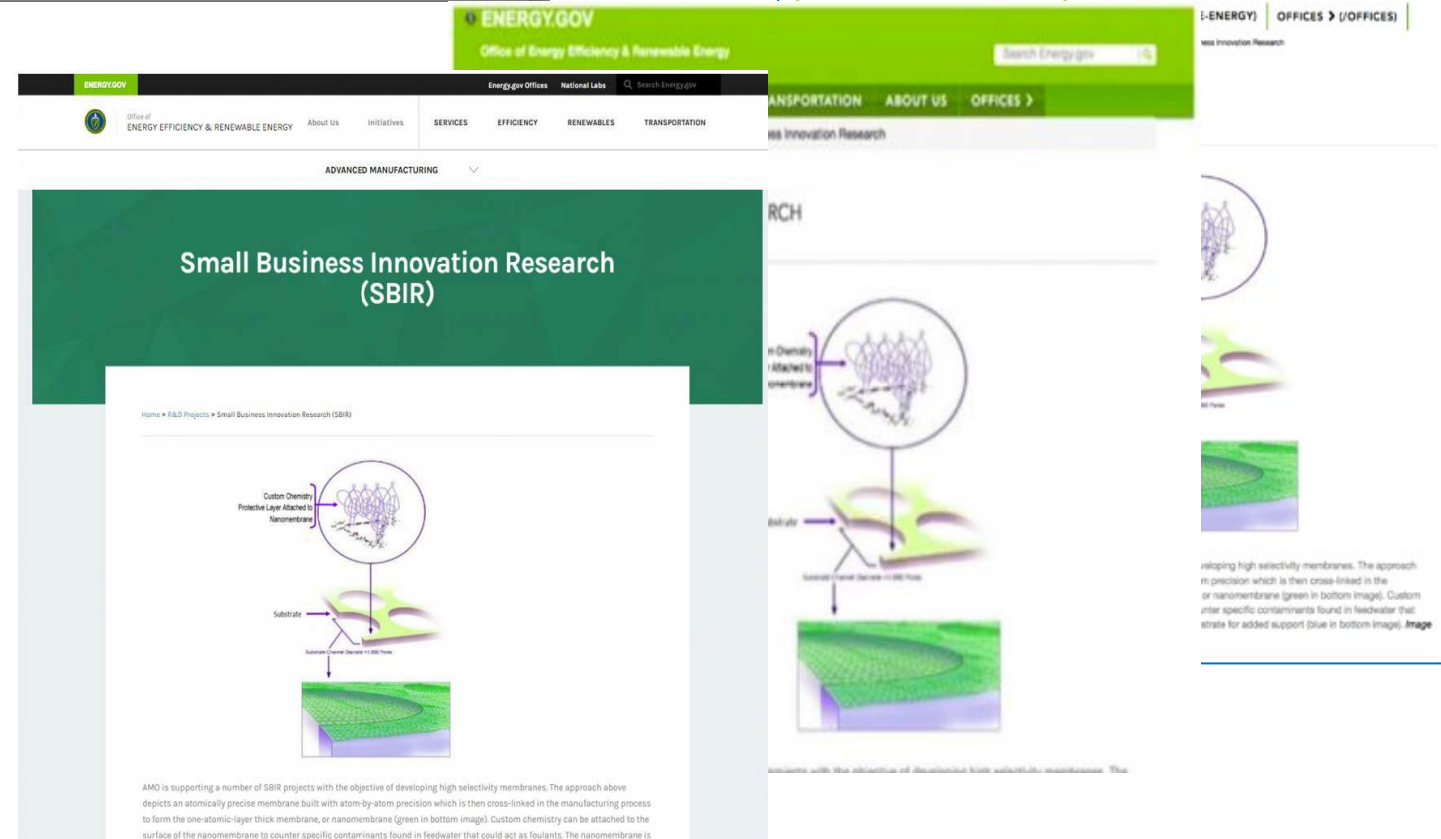
"The breakthrough that has been expected for membrane technology." - DOE

"The impact of this technology is enormous. The approach of synthesizing membranes that have the ultimate density of size selective pores is the best approach possible. Membrane filtration requires the lowest energy outlay of all approaches. The size of the potential market is enormous....- DOE

"This...membrane which offers a long list of key benefits which would be compelling under normal business circumstances, e.g., small footprint, higher yield, and reduced fouling." - DOE

"The broader impact of this technology is, of course, astounding." - NSF

"Such a technology can make the polluted feed stocks which are now off limits as impossible or too costly to clean, usable." - NSF



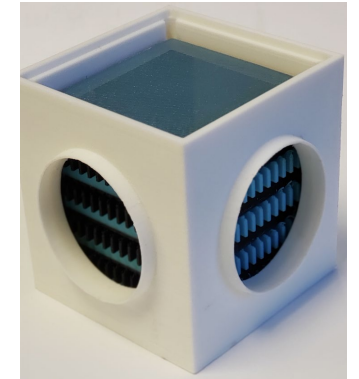
2016 2017 2018 2019
DOE splash page for 4 years across 2 administrations
this has never happened to anyone before!

Semitropic Project: *Salvagable Water*, Water Treatment Plant in a Box

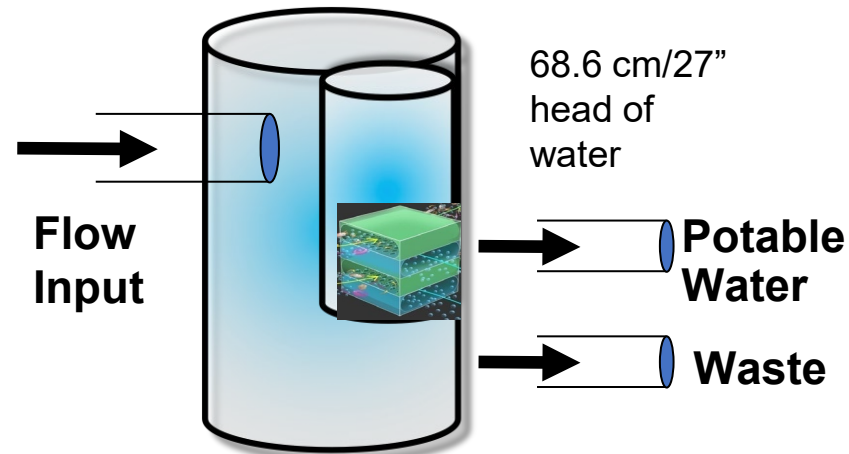
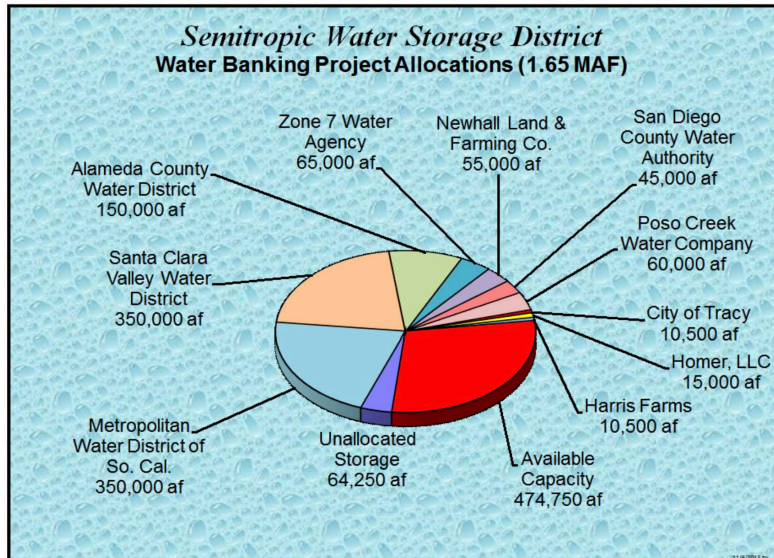


Agua Via's First Project: Semitropic
 Current Estimate on Cartridges Needed
 Phase 1: 163 cartridges = 18,000 AFY
 Phase 2: 326 cartridges = 36,000 AFY
 TOTAL: 489 cartridges = 54,000 AFY

6" cartridge produces
 100,000 gpd



Banking Partners and Allocation
 Of 1.65 Million Acre-Feet of
 Total Storage Capacity



Implications

More water: new sources, plus eliminating pre-treatments increases water yield

Increase security, supply, resiliency, reliability, quality for urban water suppliers, agricultural water suppliers, and small water suppliers and rural communities.

Water Efficiency: closed loop recycling, stormwater capture. Groundwater recharge.

Higher environmental standards possible & affordable

Massive environmental cleanup possible

Creative surprises from engineers. Distributed systems.

A lot of work ahead for water people as they restructure the way we do water.

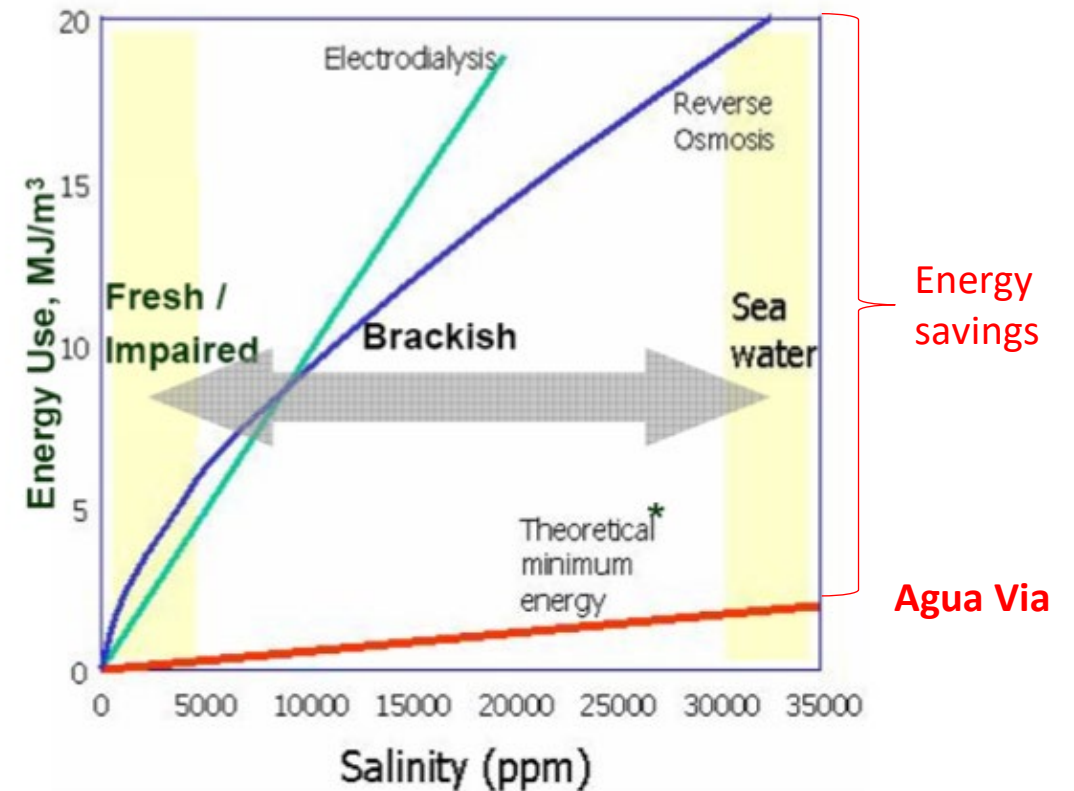


Figure 1-1
Actual vs. Theoretical Energy Intensity for Treating Saline Water

Source: Lawrence Livermore National Laboratory

Thank you