Membrane Contactor Processes
Mass transfer across the membrane is due to properties of the two fluids and the membrane characteristics.

Salinity gradients – Temperature gradients
Salinity Gradients

Drinking Water

Desalination Facility (RO)

High-Salinity Brine

Wastewater Treatment Facility

Treated Wastewater

Seawater
California Model of Desalination

How can we maximize the benefits from this resource?

Synergistic Opportunities to Utilize Wastewater

Blending after RO Scenario 1 (Baseline)

Blending before RO Scenario 3

Salinity gradient Scenario 2

Osmotic dilution Scenario 4

EOP Solver

Graph showing flow rates for different scenarios:
- Scenario 1: 3000, 2500, 2000, 1500, 1000, 500
- Scenario 2: 3000, 2500, 2000, 1500, 1000, 500
- Scenario 3: 3000, 2500, 2000, 1500, 1000, 500
- Scenario 4: 3000, 2500, 2000, 1500, 1000, 500

Legend:
- Seawater
- Treated Wastewater
- Discharge
Synergisms
1. Membrane distillation to reconcentrate draw solution
2. Low-grade heat to drive membrane distillation
3. Multiple barriers (Bio, FO, and MD) for contaminant rejection and conversion
MD Energy Consumption and Water Production

7.2 m² Aquastill MD module

- **Distillate flow rate**
  - Target: 1,000 L/d

- **Heat and Pumping Power**
  - 1.9 – 8.9 kWth Heat
  - 0.004 – 0.011 kWel Pumping
  - (0.31 – 0.54 kWel Fan + Radiator)
  - For optional air cooling

- **Seawater Energy and Cost Efficiency (SEEC)**
  - 3.0 – 11.2 kWth Heat
  - 0.004 – 0.011 kWel Pumping

- **Salinity (g/L)**
  - 0, 35, 70

- **Temperature Ranges**
  - 75°C-20°C
  - 60°C-20°C
  - 80°C-35°C

**Graph**
- Shows distillate flow rate (L/hr) vs. salinity (g/L) for different temperature ranges.
- Green: 75°C-20°C
- Brown: 60°C-20°C
- Grey: 80°C-35°C

**Legend**
- 0 kWth, 0 kWel
- 3 kWth, 0 kWel
- 7 kWth, 0 kWel
- 10 kWth, 0 kWel
- 12 kWth, 0 kWel

**Notes**
- For optional air cooling.
UF-RO Potable Water Reuse Pilot System

• Global Reach, Local Impact
  – Global
    • New treatment schemes towards sustainable potable water reuse and inland desalination
    • Real-time chemical and microbial detection methods
    • Rapid deployment and emergency response systems
  – Local
    • Water independency
    • Alternative water source in remote communities
    • Economic development
• Outreach
  – Workforce development for the technicians of the 21st Century in partnership with Community Colleges
  – Demonstration facility for K-12 education
Rapid Integrated Course on Membrane Processes

- 18-Months project to develop a 4-day hands-on course on process intensification
- Co-Pis: Prof. Edoardo Saez and Prof. Kim Ogden