

Project 1: RO-Wave Energy

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Context

The Experiment

The Question

The Data

Variables

EDA

Context

- ▶ Desalinized ocean water is a logical source of drinking water, especially for coastal cities.
- ▶ Desalinization is energy intensive and many coastal towns do not have ready access to the necessary resources.
- ▶ What if waves are converted to energy to desalinate water via reverse osmosis?

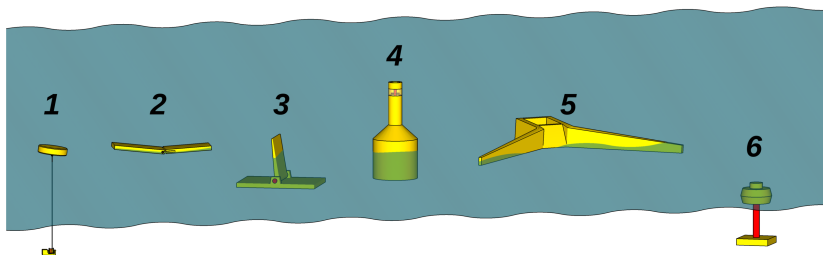
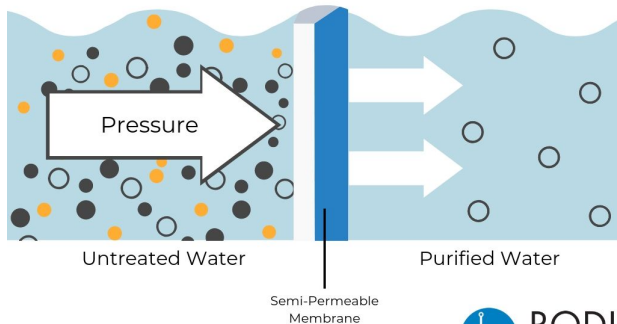


Figure: Wave Energy: Wikipedia

The Experiment

- ▶ The data are from a hydrokinetic reverse osmosis pilot, in collaboration with the National Renewable Energy Laboratory.

Reverse Osmosis



The Experiment

- ▶ They were testing how RO membranes operate when pressure is powered by tidal energy.
- ▶ Starting with fixed flux pressure to establish steady state conditions, high or low cycle pressure was introduced.
- ▶ Pressure was generated through a feed pump and reject valve.
- ▶ Many experiments were performed, with measurements made every minute.
- ▶ The RO membrane was exposed to hundreds of “waves” every minute.
- ▶ Data were collected both on operational and conductivity variables.

The Experiment

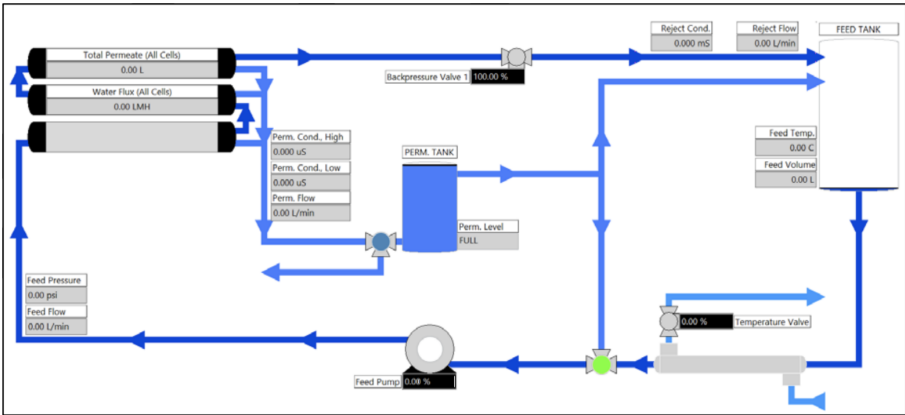


Figure: System Diagram: HKRO Manuscript

The Question

- ▶ ***Does variable (rather than fixed) feed pressure have a significant effect on reverse osmosis membrane integrity or performance?***
- ▶ **Integrity:** How well does the membrane “hold up” under pressure?
 - ▶ This is measured by a water permeability coefficient, A .
 - ▶ $A \approx \frac{\text{Water Flux}}{\Delta_{\text{Influent/Effluent Pressure}}}$
 - ▶ Water Flux represents the rate of membrane permeation.
- ▶ **Performance:** What is the final product quality?
 - ▶ Quality is measured by conductivity, a surrogate for dissolved solids.
 - ▶ Lower conductivity is “better.”

The Data

Variables

- ▶ There are 23 variables in this dataset, representing operational measurements and water quality measurements.
- ▶ Membrane integrity is calculated from the operational variables.

Category	Variable	Coefficients
Operational	Pressure	1
	Volume	3
	Temperature	1
	Flowrates	3
	Permeability	1
Water Quality	Conductivity	3
Other	Date, Time	4
	System Settings	5+

The Data

EDA

Check out an EDA