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Making Desalination Affordable

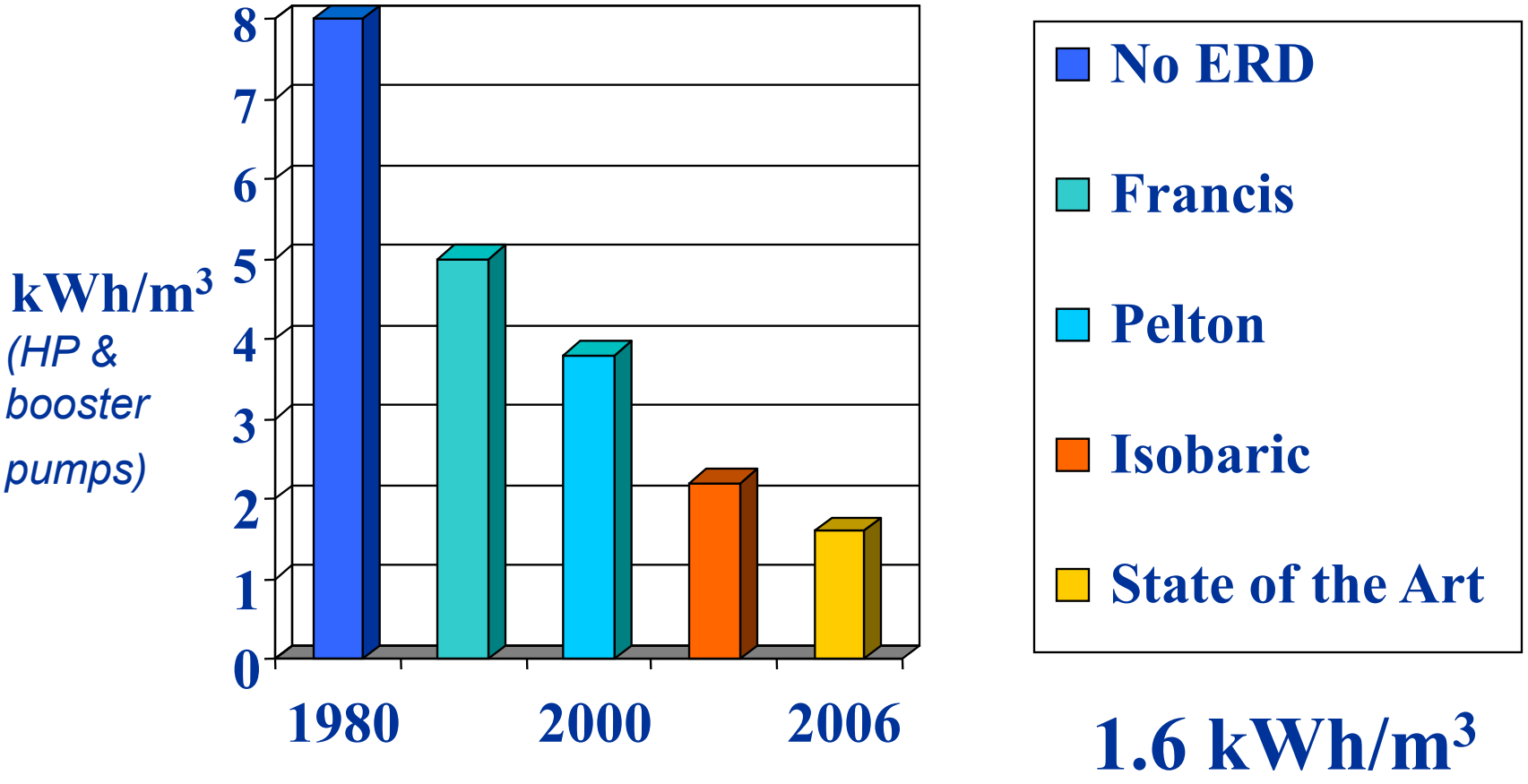
Richard L. Stover, Ph.D.

MONTPELLIER, FRANCE

May 23, 2006

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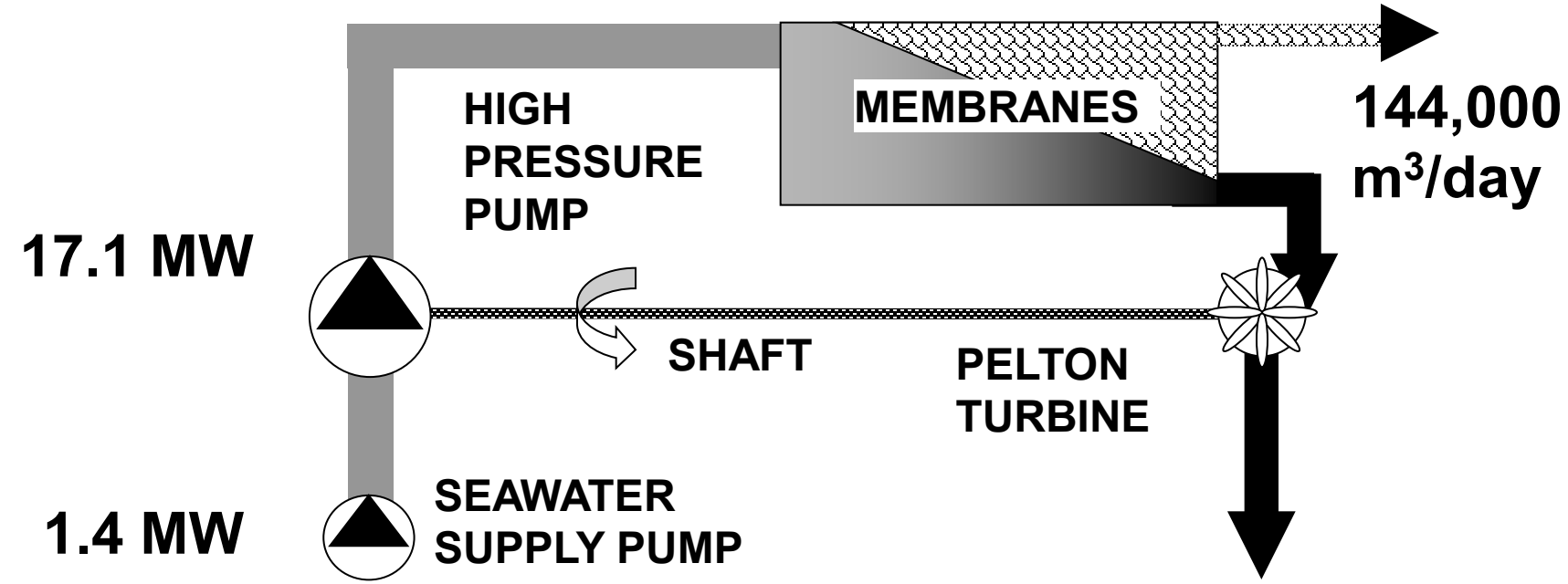
SWRO Power Consumption



Energy recovery devices driving down SWRO costs.

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Pelton Wheel

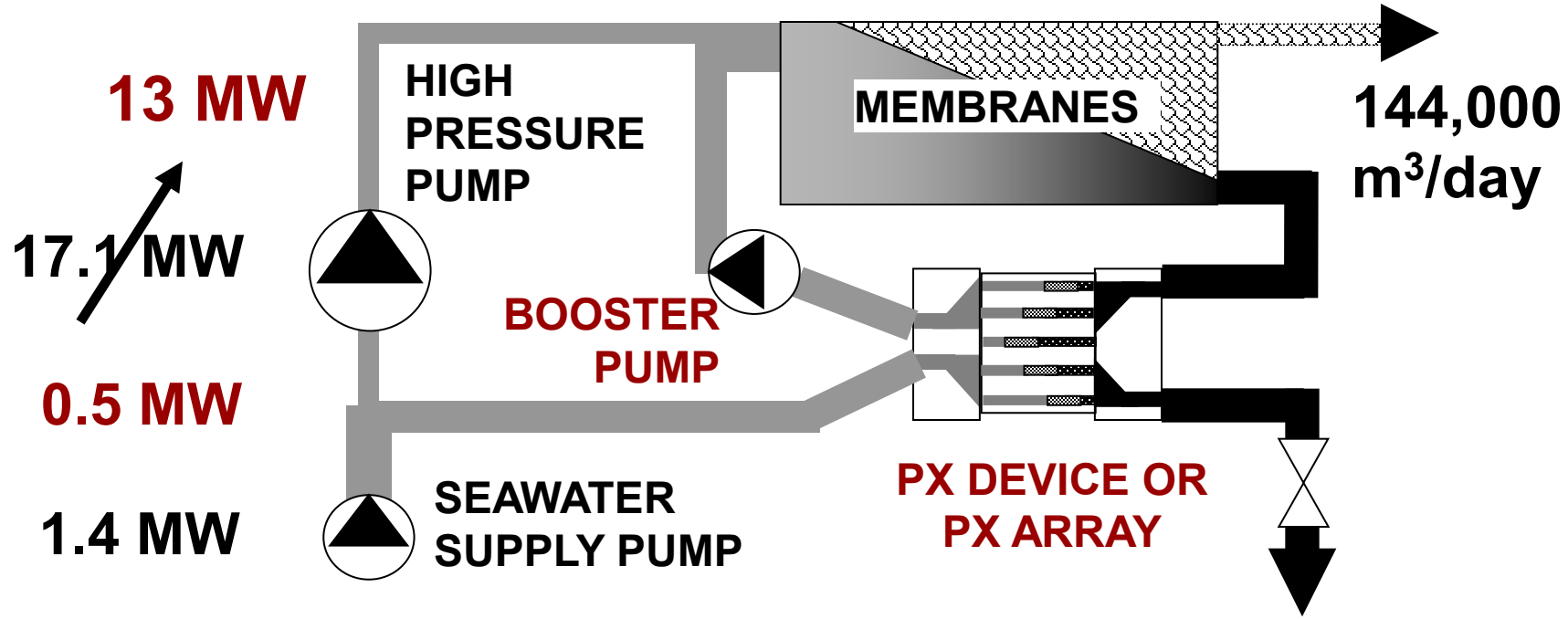


89% turbine efficiency
X 84% pump efficiency
= 75% transfer efficiency

Get more energy from the brine.

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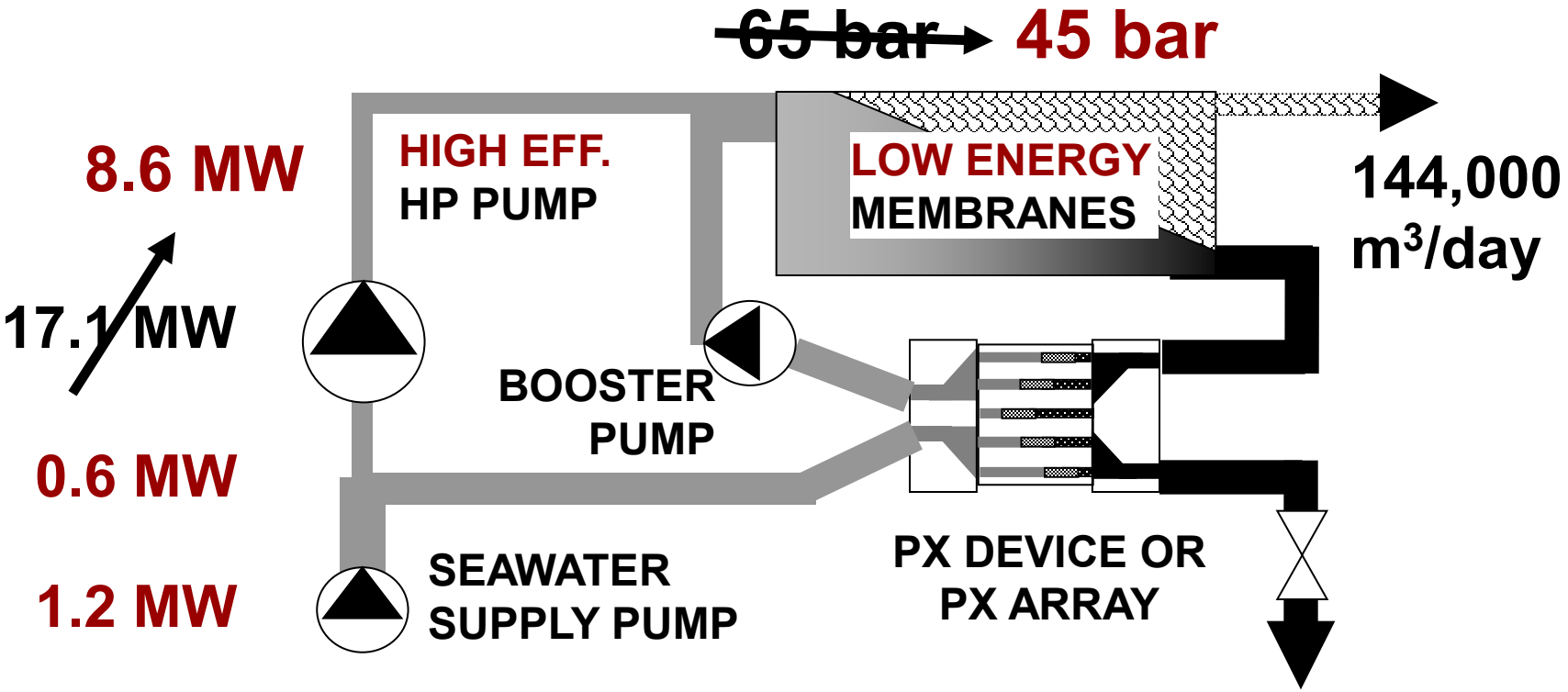
PX Pressure Exchanger



Payback in less than 2 years.

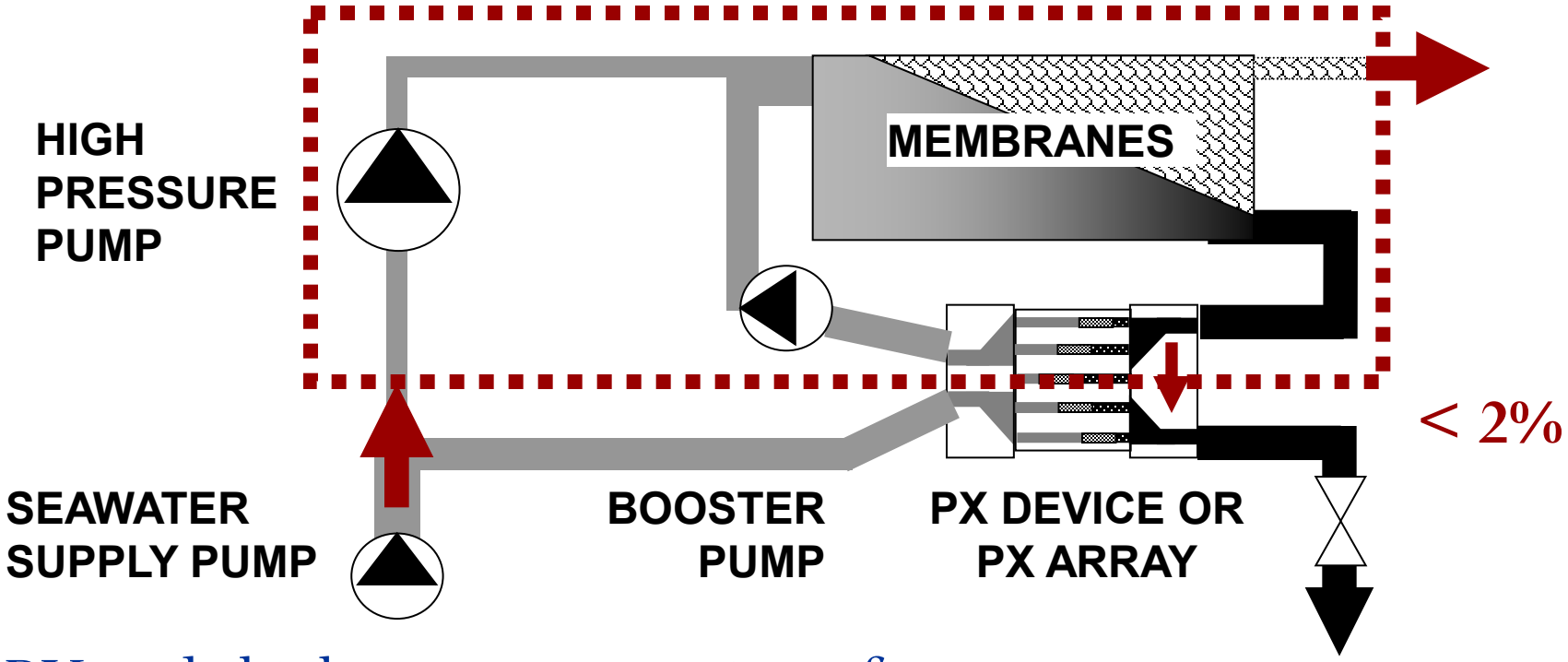
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State of the Art SWRO System



1.7 kWh/m³ energy consumption (incl. supply).

Low Recovery and Isobaric ERDs



PX seals high pressure portion of process

HP pump flow ≈ permeate flow

Membrane recovery adjustable with booster pump

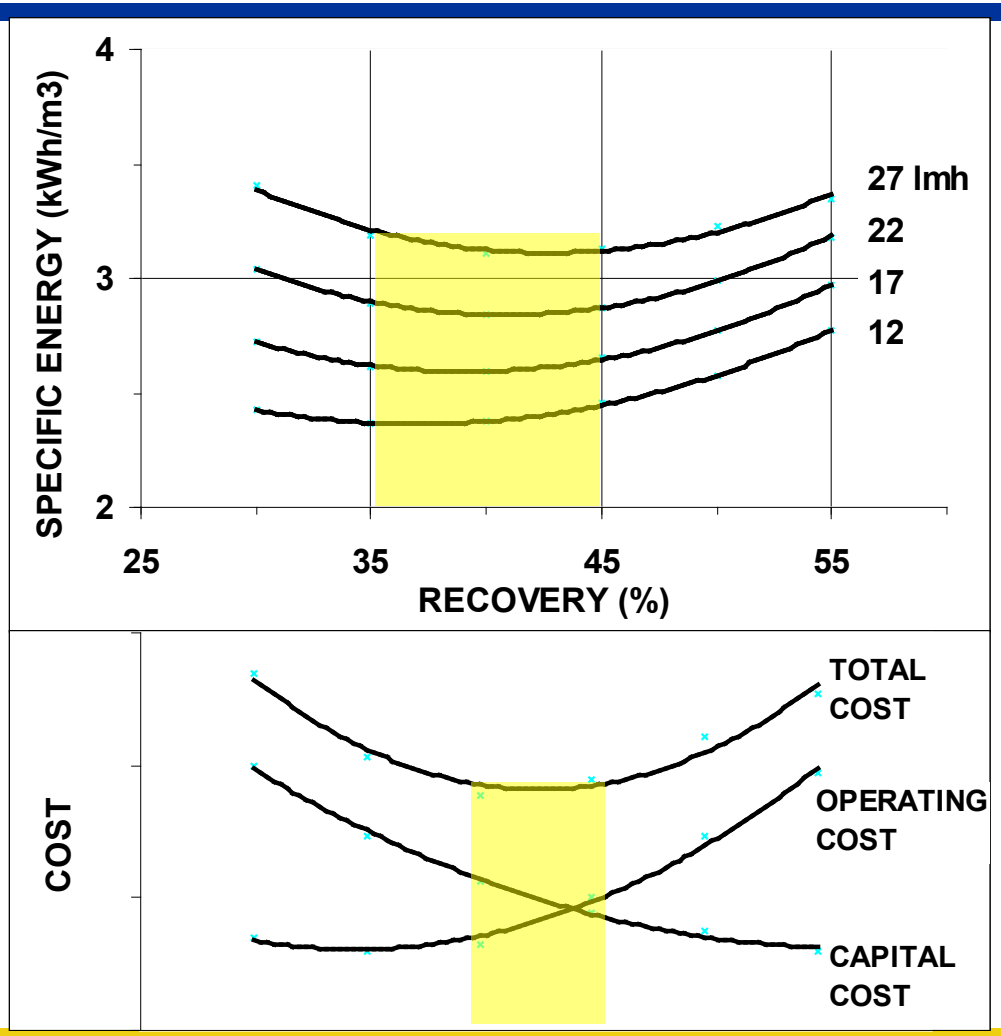
Low recovery is affordable with PX.

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Low Recovery and Isobaric ERDs

Less energy used at low recovery, low flux.

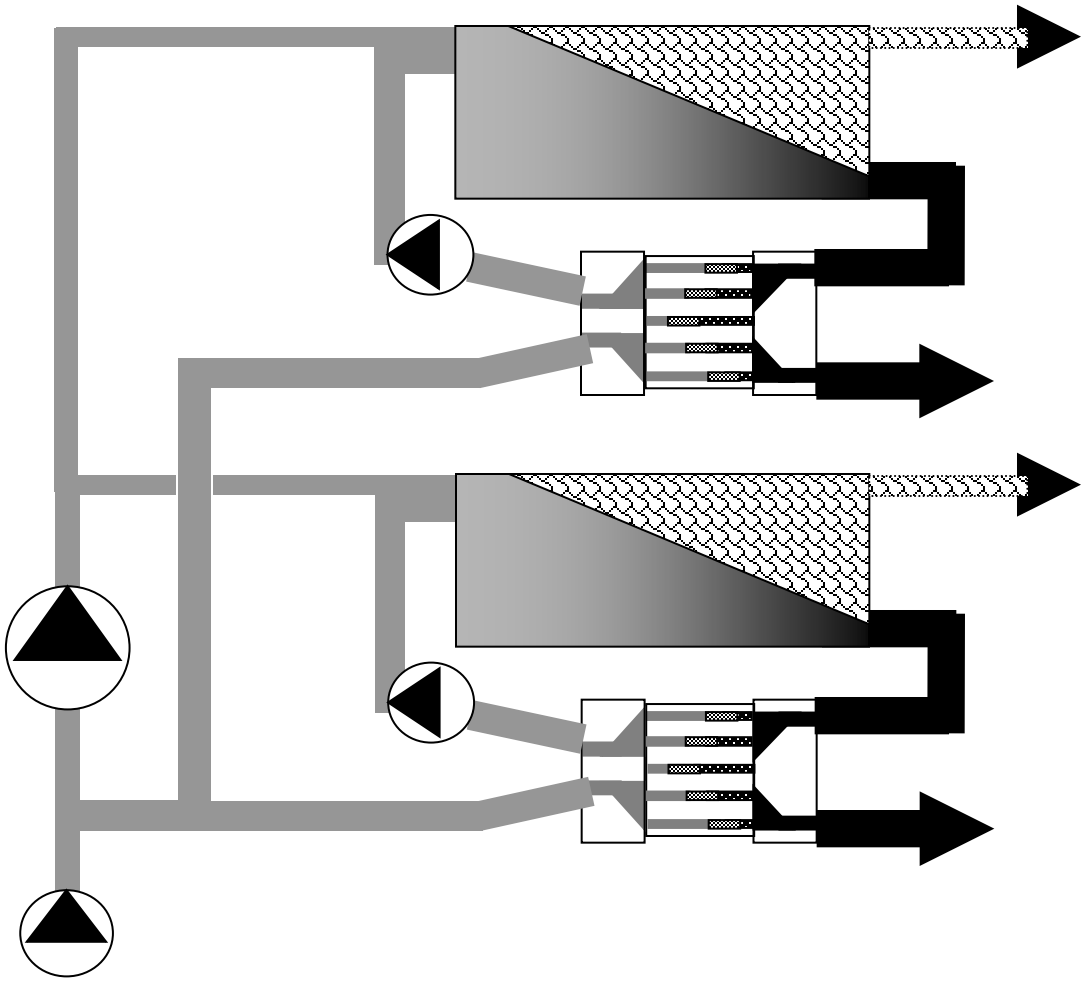
Optimize for minimum total cost.



Low recovery reduces scaling, reduces chemicals, saves membranes and saves money.

High Efficiency Process Designs

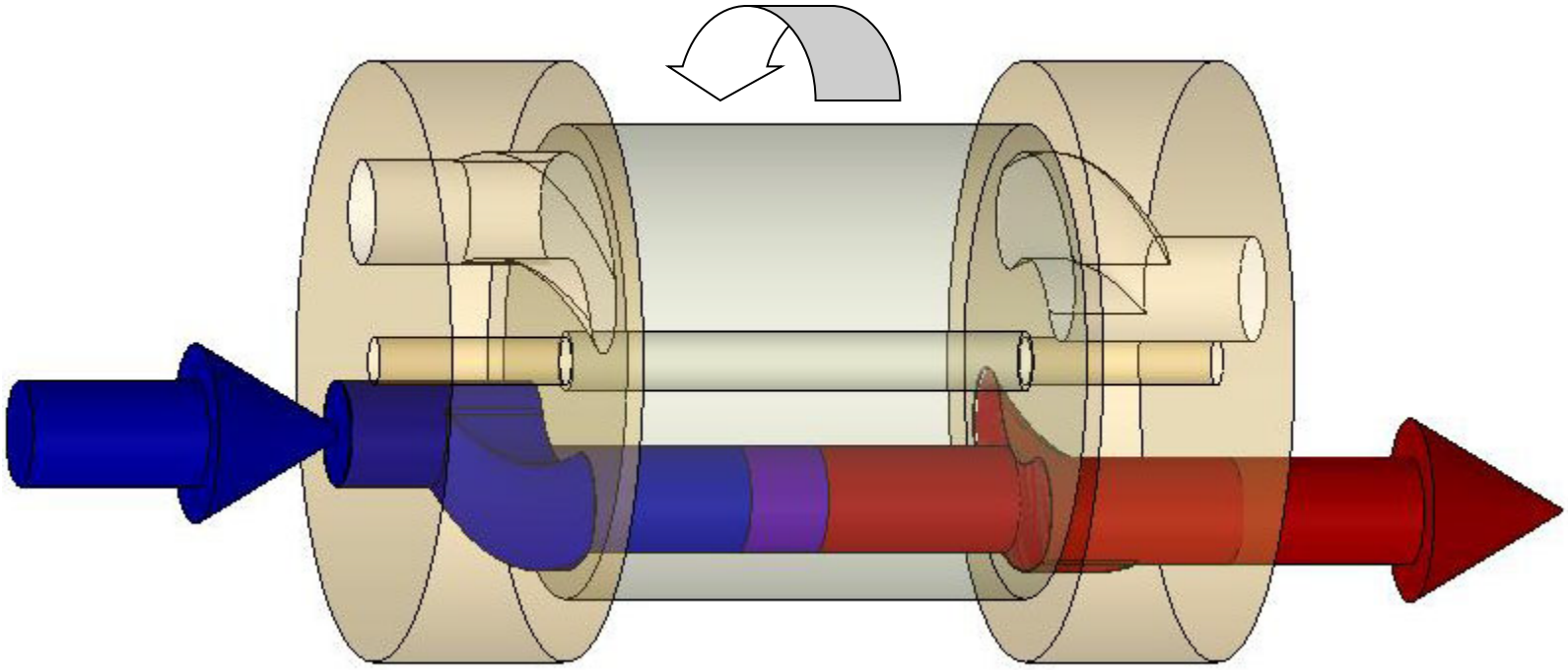
Isobaric ERDs
separate ERD
from HP pump



Larger pumps = higher efficiency.

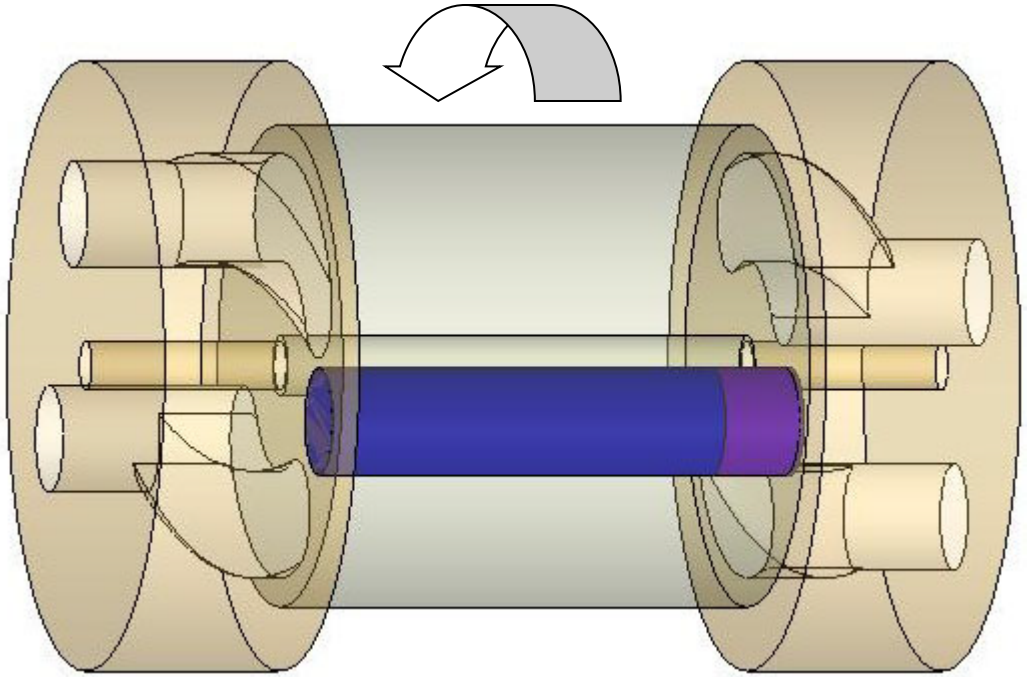
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PX Mechanism



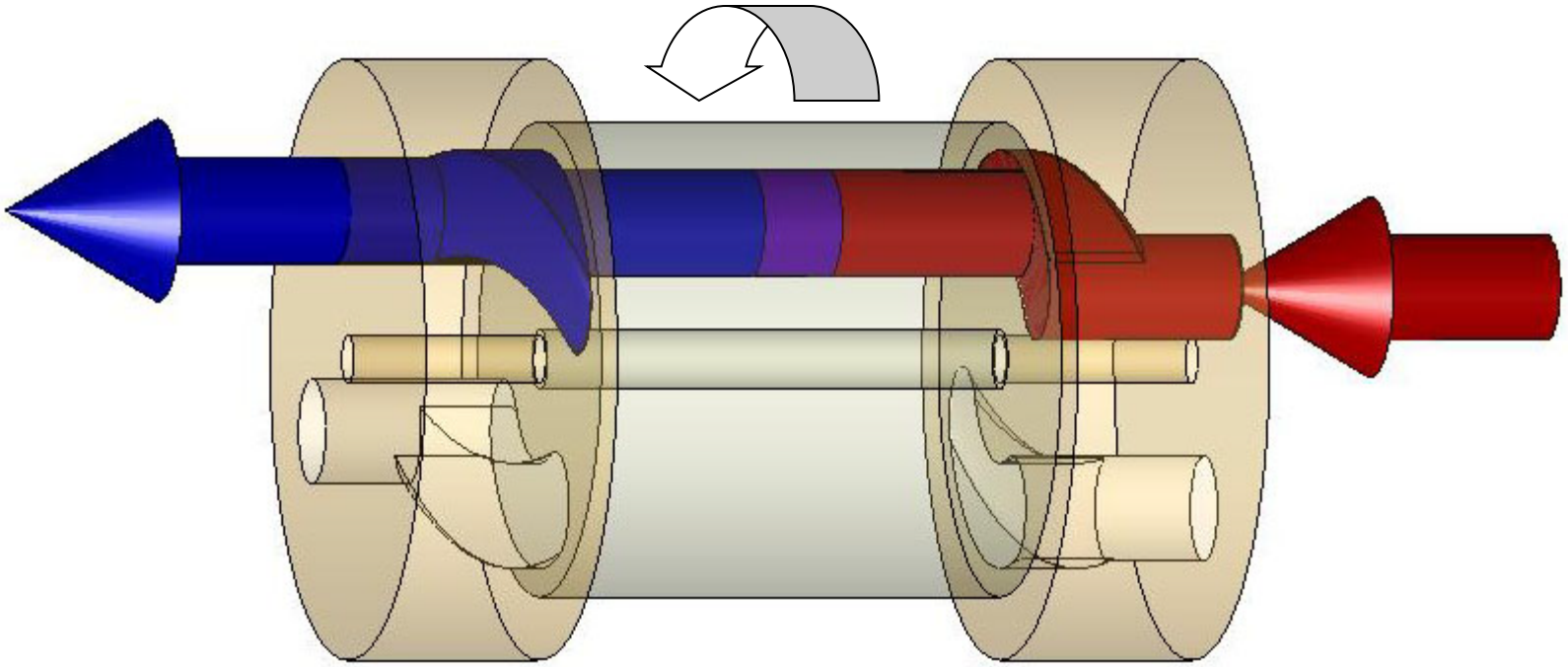
1. Low-pressure feed water fills rotor chamber, displacing brine.

PX Mechanism



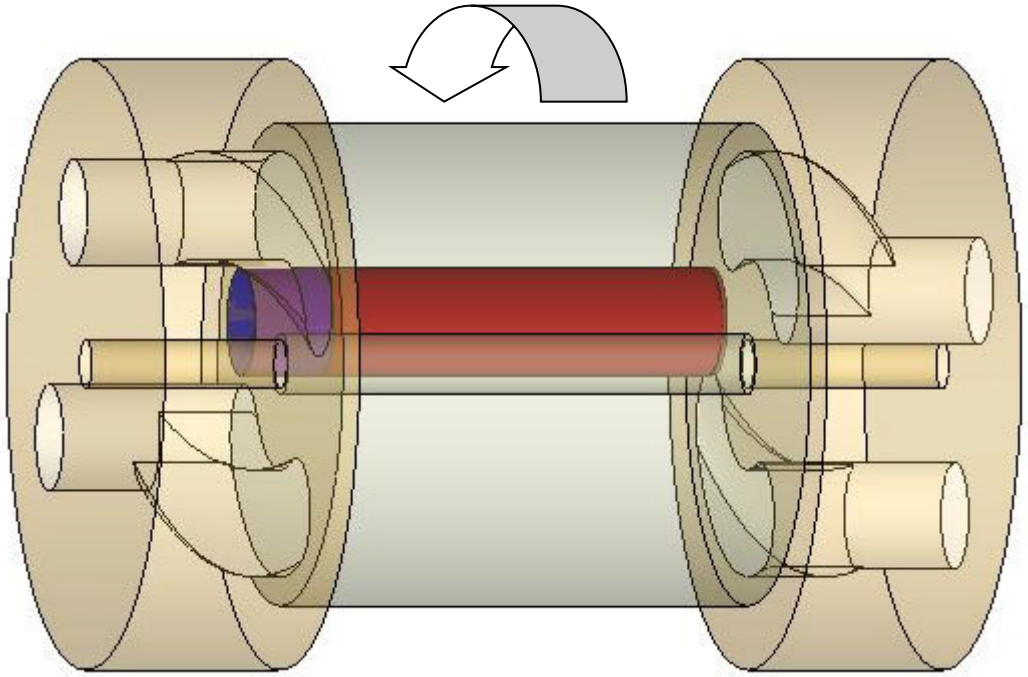
2. Rotor chamber seals, containing low-pressure feed water.

PX Mechanism



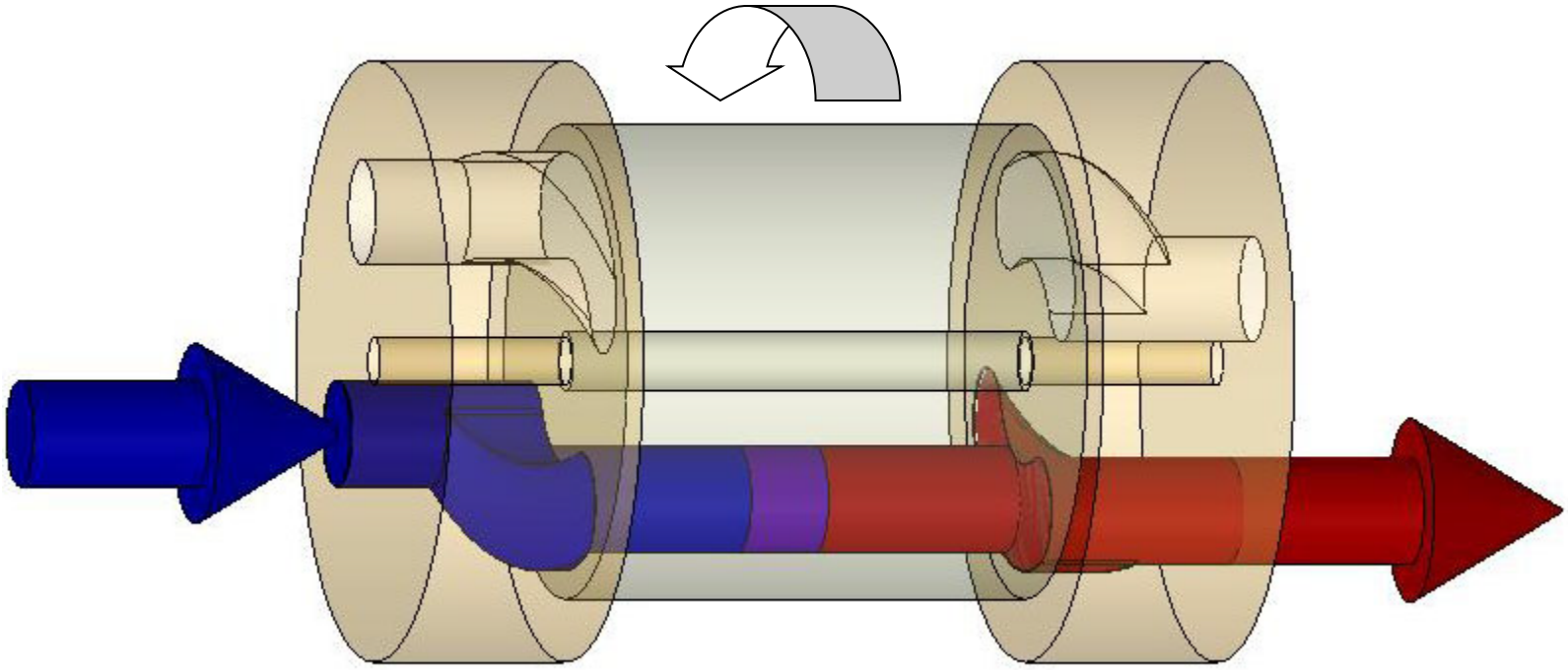
3. High-pressure brine compresses and displaces feed water.

PX Mechanism



4. Rotor chamber seals, containing high pressure brine.

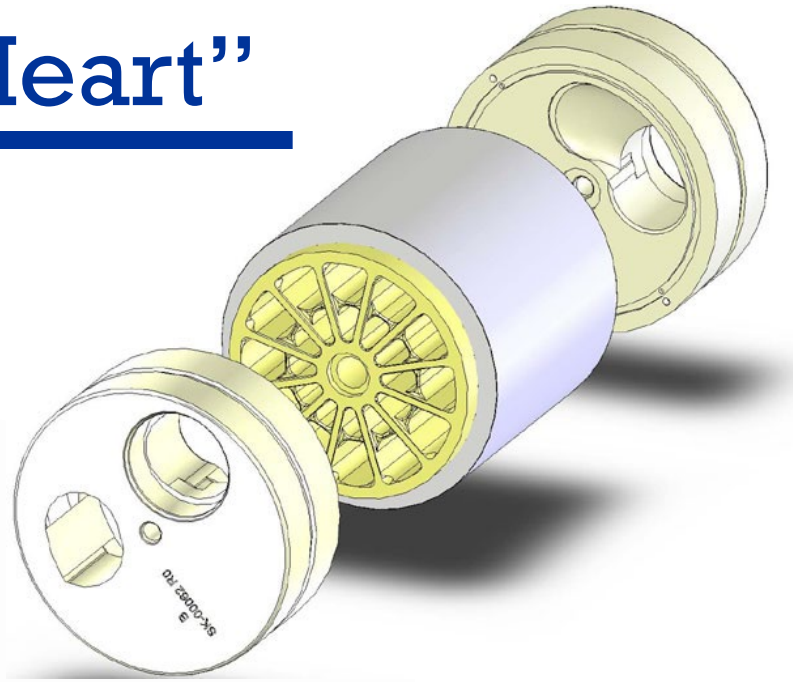
PX Mechanism



1. Low-pressure feed water fills rotor chamber, displacing brine.

The PX's Ceramic "Heart"

- Narrow Gaps
- 3X Harder than Steel
- Corrosion Proof
- Seawater Bearing
- One Moving Part
- Controlled by Flow
- No Pistons
  - Easy to start and stop
  - Fail "safe"
  - Mixing



endcover rotor/sleeve endcover

Ceramic is ideal for high-pressure seawater.

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ERD Energy Comparison

	Pelton	Piston	**PX**
HP Pump Efficiency	84%	84%	**84%**
ERD Mixing	0%	0.7%	**2.8%**
ERD Efficiency	75%	94%	**96%**
kWh/m^3	3.24	2.72	**2.72**

Example

- Large pumps increase efficiency
- All isobaric ERDs have mixing
- 2% less mixing = 1% more efficiency

PX & piston ERDs same kWh/m^3 … BUT …

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Other Considerations

MAXIMUM UPTIME

- Automatic startup and shut down
- Simple controls (flow and pressure only)
- Fail safe: open flow channels through PX
- No regular maintenance required

LONG LIFE

- No corrosion
- Low pulsations
- Guaranteed performance

HIGHEST EFFICIENCY *measured in* kWh/m^3

PX

The lowest lifetime cost.

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Merci!

Thank You!

