



# Energy and Water Development and Innovation

**Energy & Water  
Nexus Summit II**

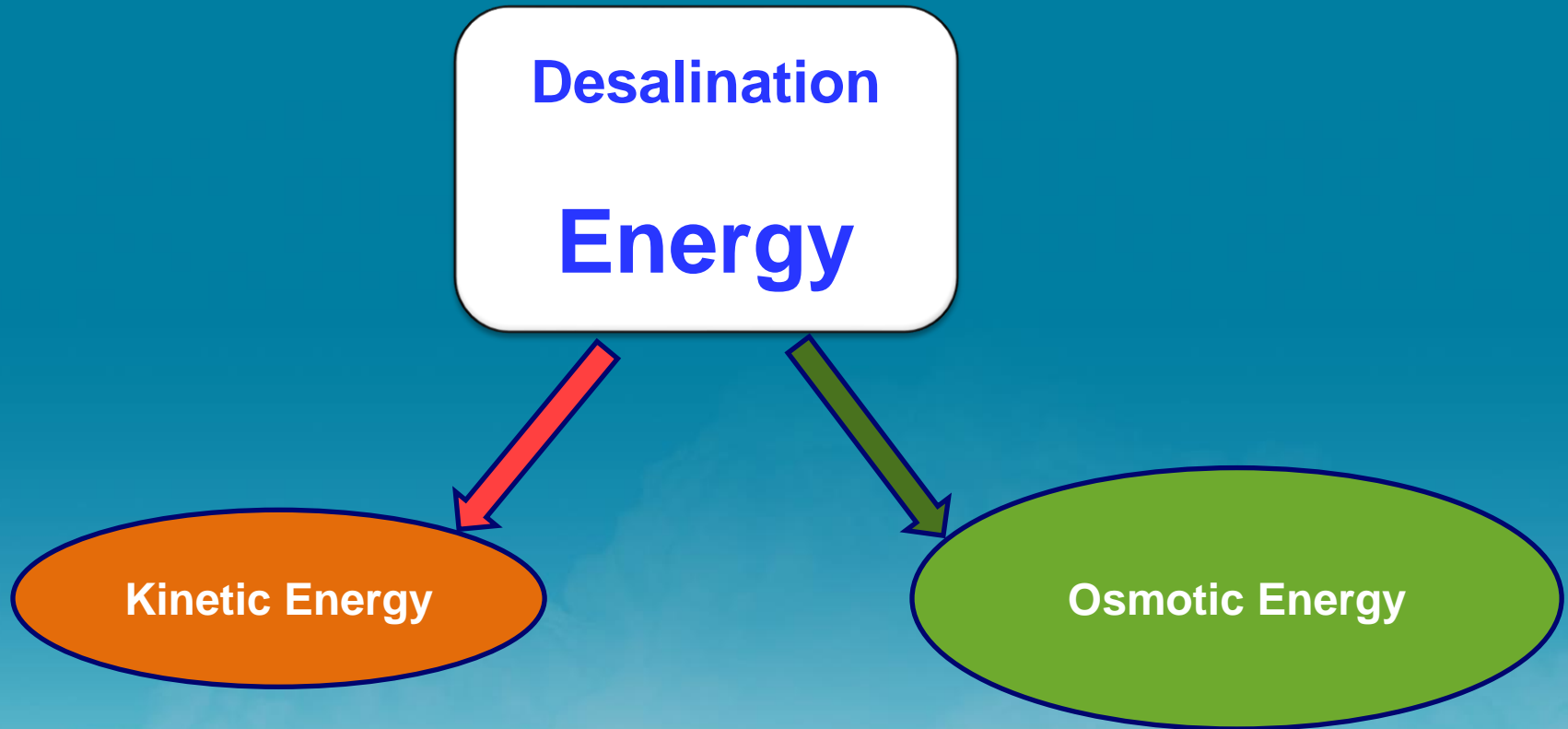
**Val S. Frenkel, PhD, PE, DWRE**

# Energy Consumption by Desalination

**Desalination**

**Energy**

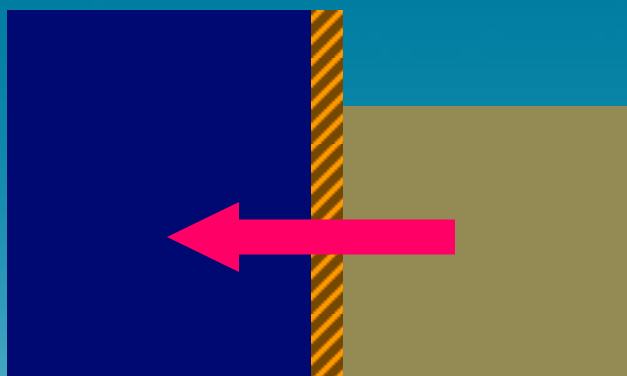
# Energy Consumption by Desalination



# Osmosis

Pacific Ocean  
TDS = 35,000 mg/l  
Osmotic Pressure = 350 psi

No external pressure



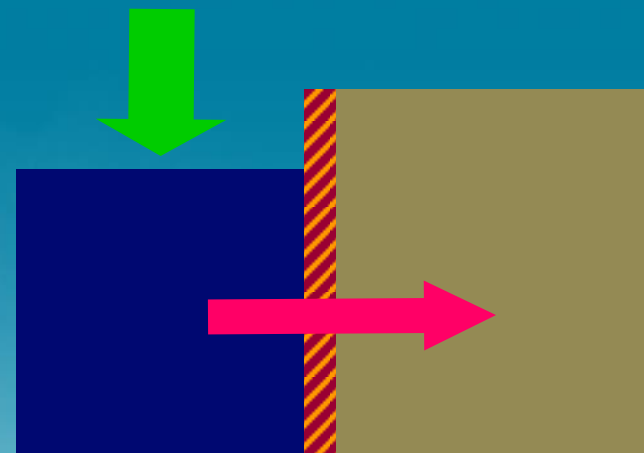
Concentrated  
Solution

Diluted  
Solution

# Reverse Osmosis

RO reject at R=50%, TDS = 67,000 mg/l  
Osmotic Pressure = 670 psi  
Operational Pressure = 750 - 850 psi

External pressure

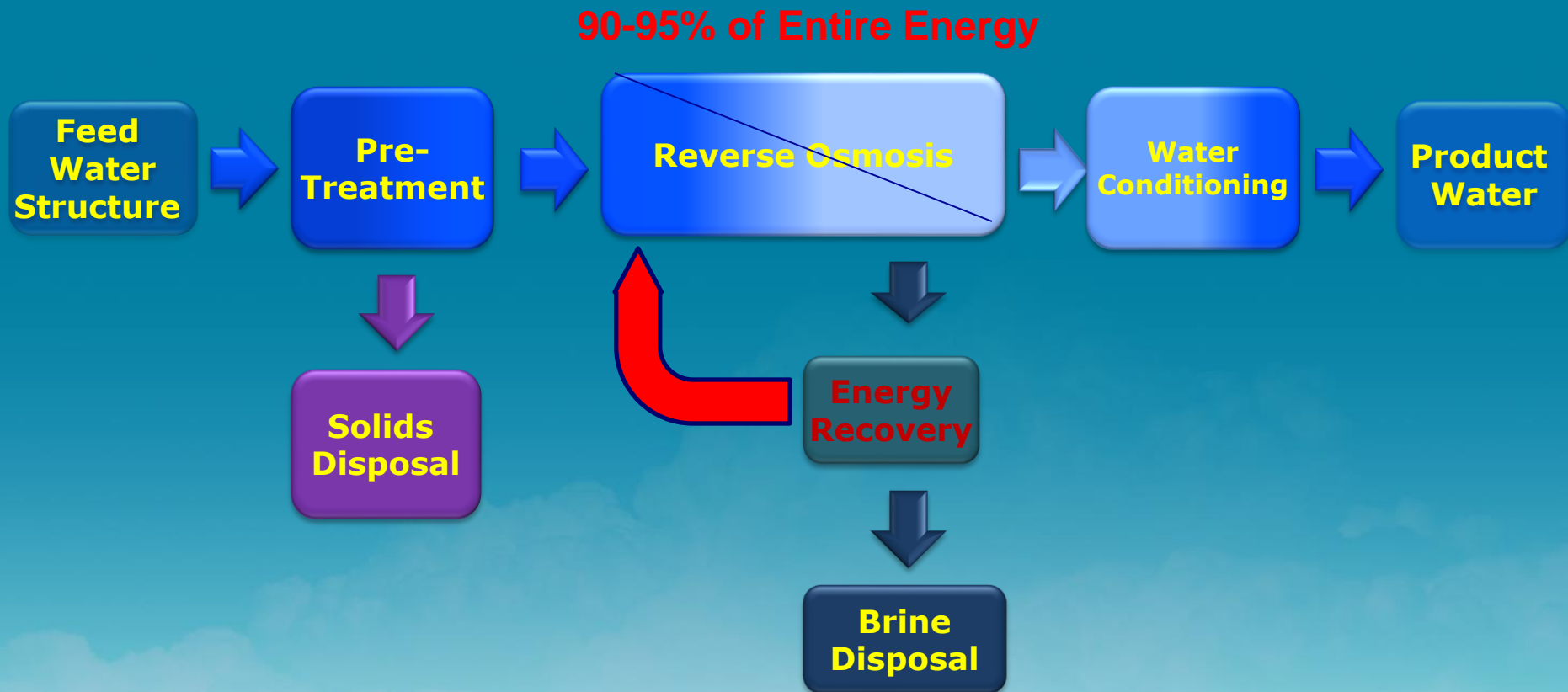


Concentrated  
Solution

Diluted  
Solution

**100 mg/l TDS = 1 psi**

# Reverse Osmosis Desalination Process Schematic





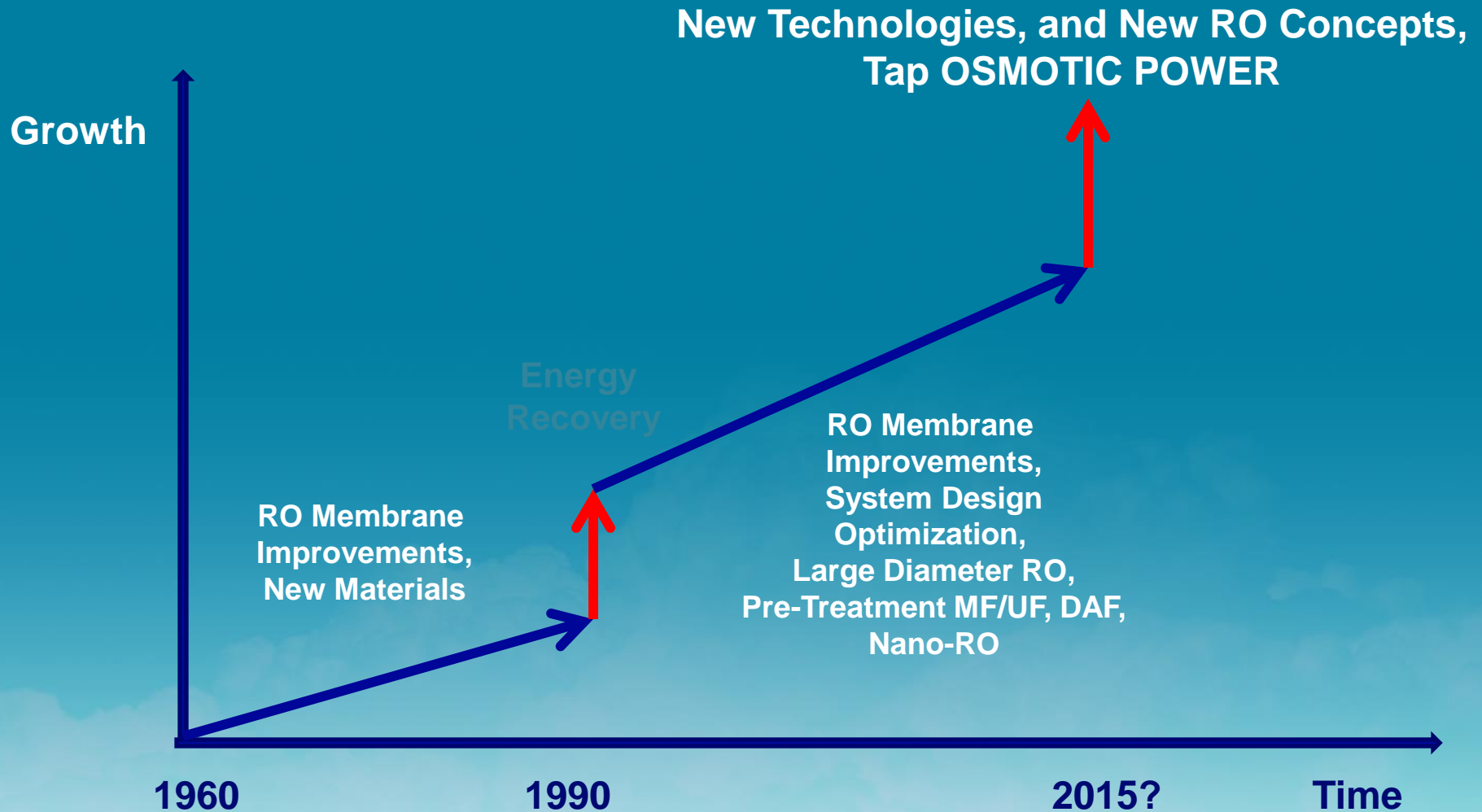
## Typical Breakdown of Desalination Cost, %

	Seawater	Brackish water
Fixed costs	35 %	50 %
Energy	45 %	15 %
Labor	5 %	10 %
Membrane s replacement	5 %	5 %
Maintenance	7 %	10 %
Consumables	3 %	10 %

# Osmotic Energy = Battery



# RO Desalination Technology Growth Trends







Thank you!

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