

# Desalination Technology Trends and CH2M HILL

*Presented to the*

***WSTA Conference, 2008***

*by*

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## Presentation Outline

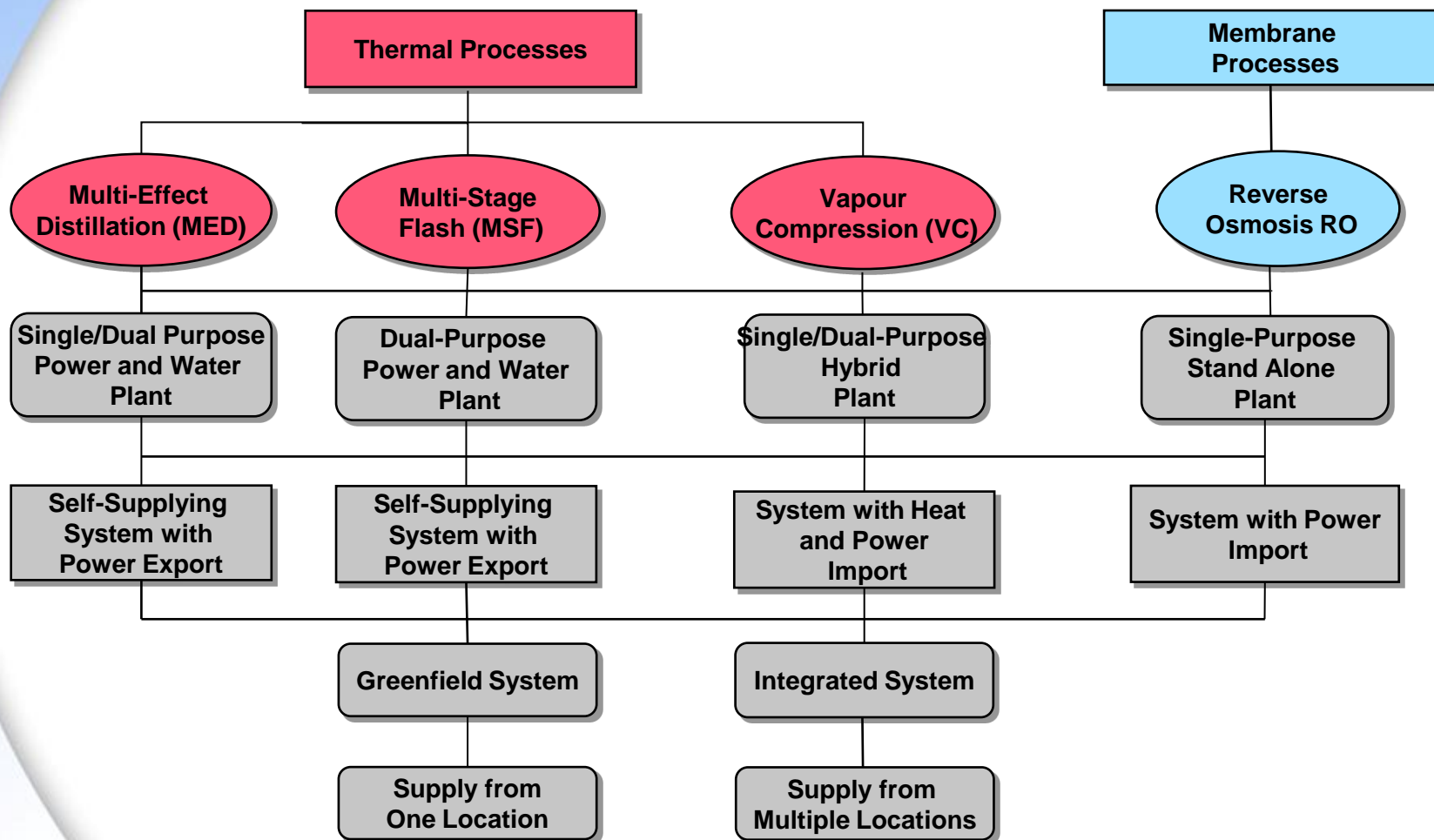
- The Growing Desalination Market
- Trends in the Technology/Marketplace
  - Thermal
  - Desalination



# The Growing Desalination Market

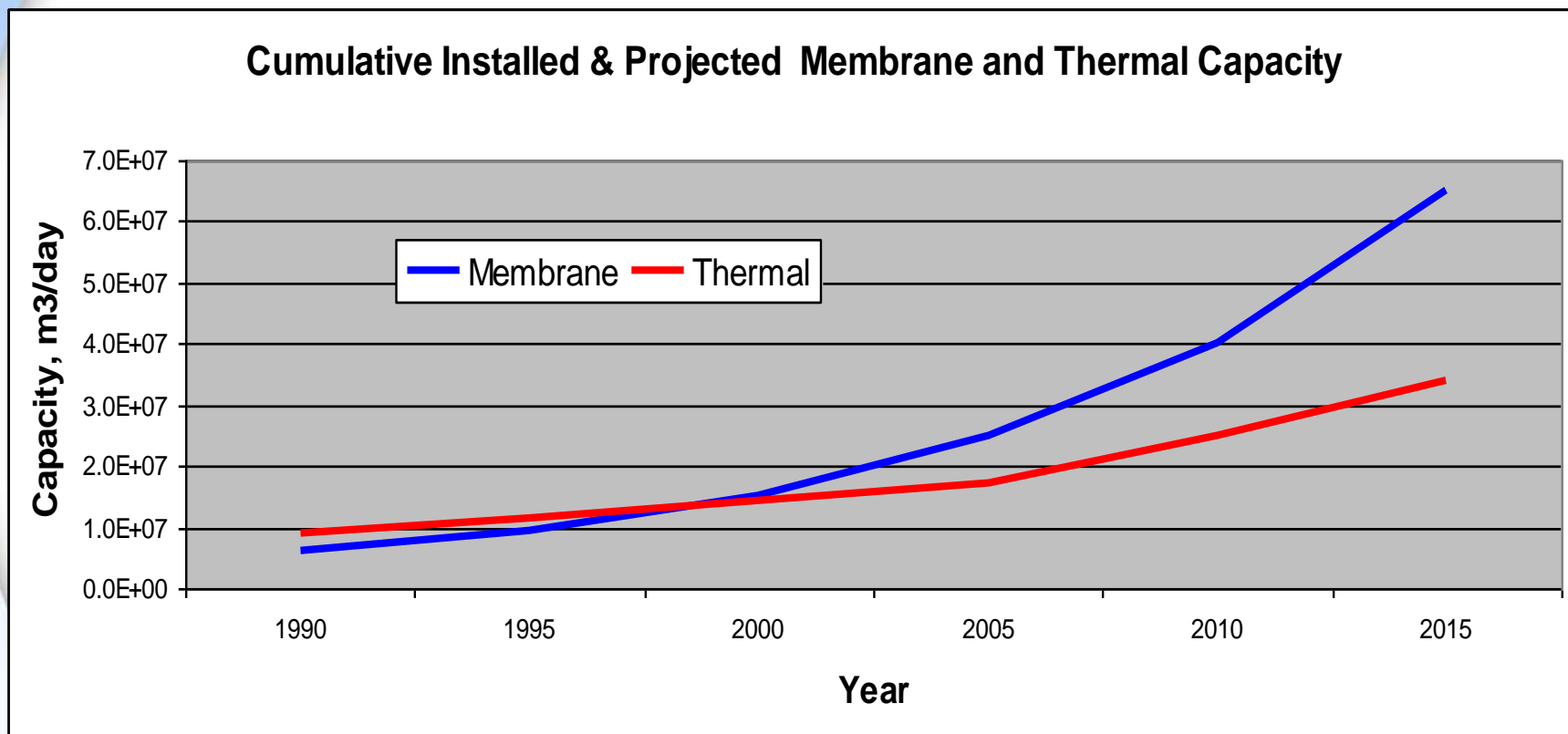


# Desalination Process Options

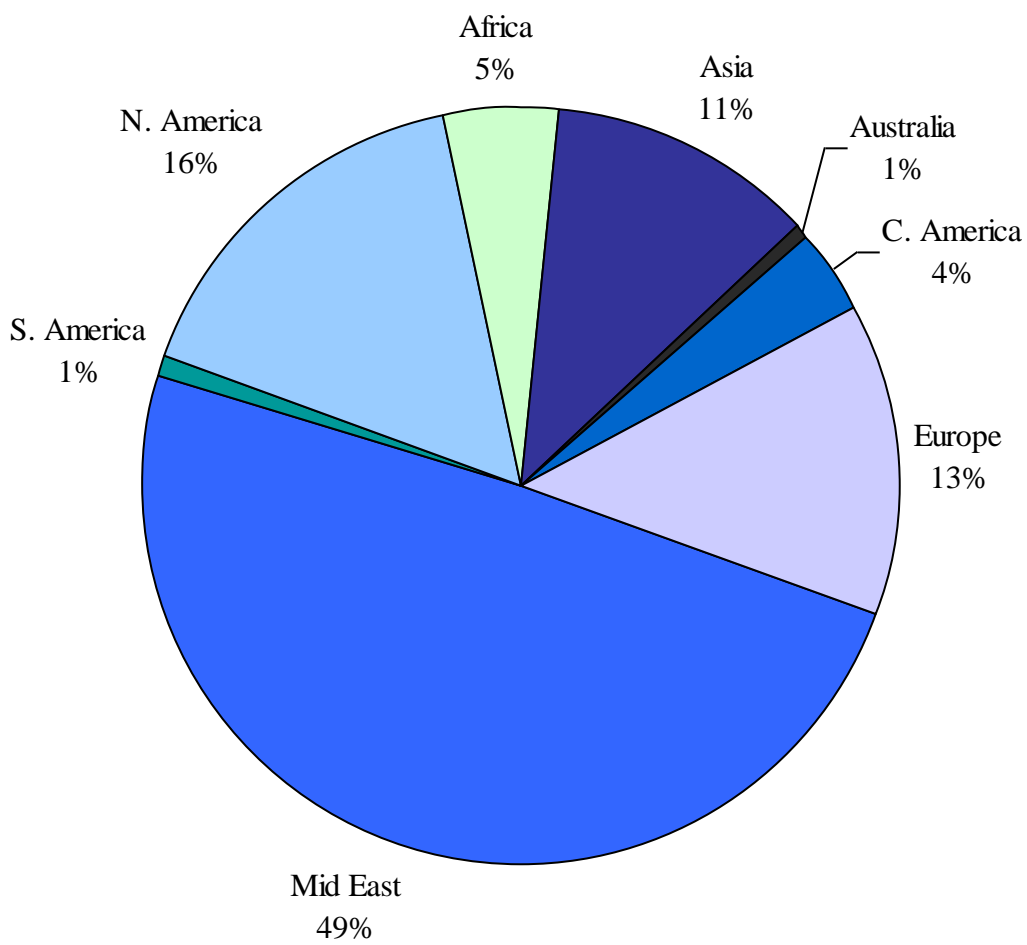




# Where Are We Going?

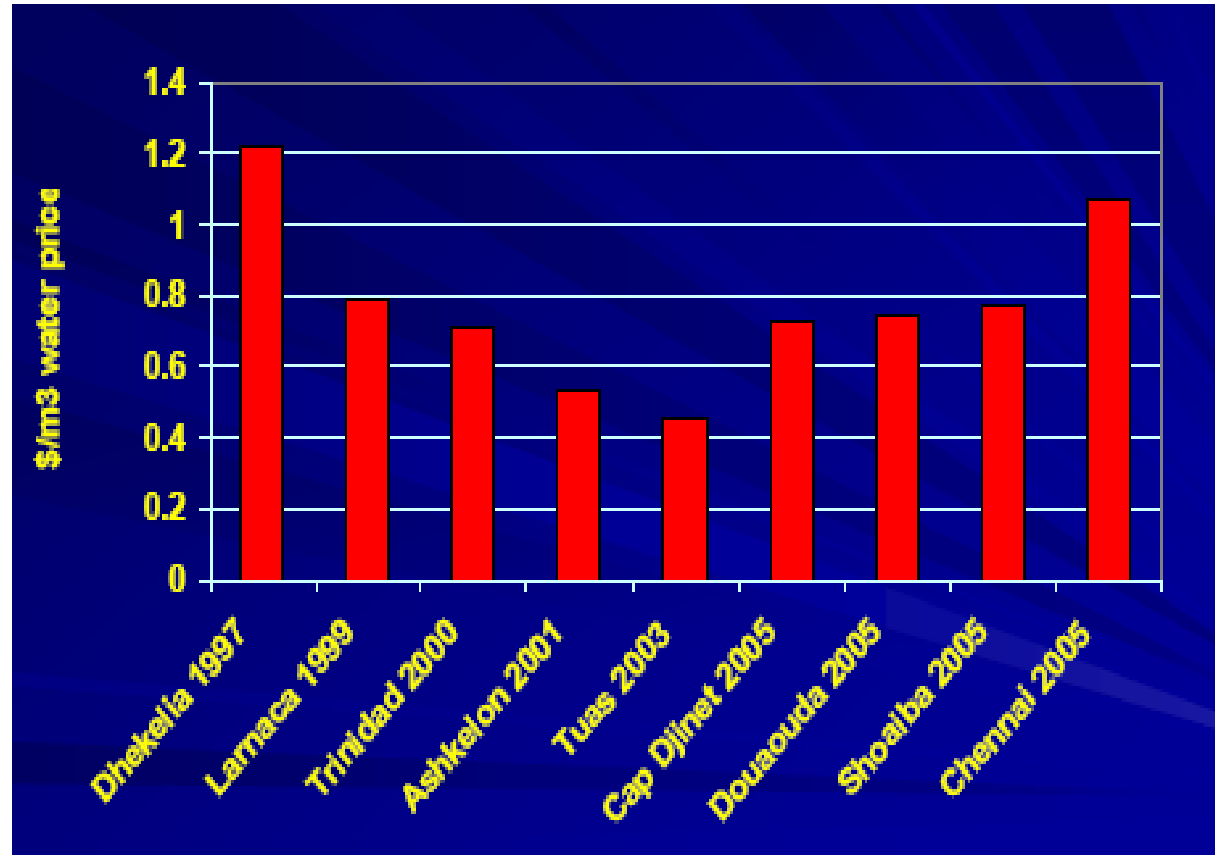


# Regional Distribution of Desalination Technology





# Total Water Costs – Price History



Reference: Christopher Gasson, *Global Water Intelligence*, IDA Water Forum 2006 - Dubai



# Market Drivers

- Cost and availability of traditional supply
  - ▶ Surface waters
  - ▶ Groundwater
- Decreased cost of desalination
- Growing economy and populations – M.E.
- Diversification of supply – Climate Change and Drought – US and Australia
- Demographics – People want to live coastally where water availability is limited





# Trends in the Technology/Marketplace

## *Thermal and Membrane*



# Trend: Larger Unit Capacity

- **MED units installed to 36,600 m<sup>3</sup>/d**
- **MSF units installed to 75,850+ m<sup>3</sup>/d**
- **MVC units installed to 2,880 m<sup>3</sup>/d**





# Trend: MED replaces MSF

## Comparing Process in a 340,650 m<sup>3</sup>/d Facility

	<u>MSF</u>	<u>MED-TC</u>
<b>Number Units</b>	<b>5</b>	<b>12</b>
<b>Unit Capacity</b>	<b>68,130 m<sup>3</sup>/d</b>	<b>28,930 m<sup>3</sup>/d</b>
<b>Total Steam</b>	<b>1860 T/h</b>	<b>1860 T/h</b>
<b>Steam Pressure</b>	<b>1.5 bar g</b>	<b>5 bar g</b>
<b>Absorbed Power</b>	<b>42 MW</b>	<b>17 MW</b>
<b>Land Area</b>	<b>127m x 385m</b>	<b>110m x 250m</b>
<b>Est Turnkey Cost</b>	<b>\$375 million</b>	<b>\$265 million</b>

*courtesy of Weir Techna*



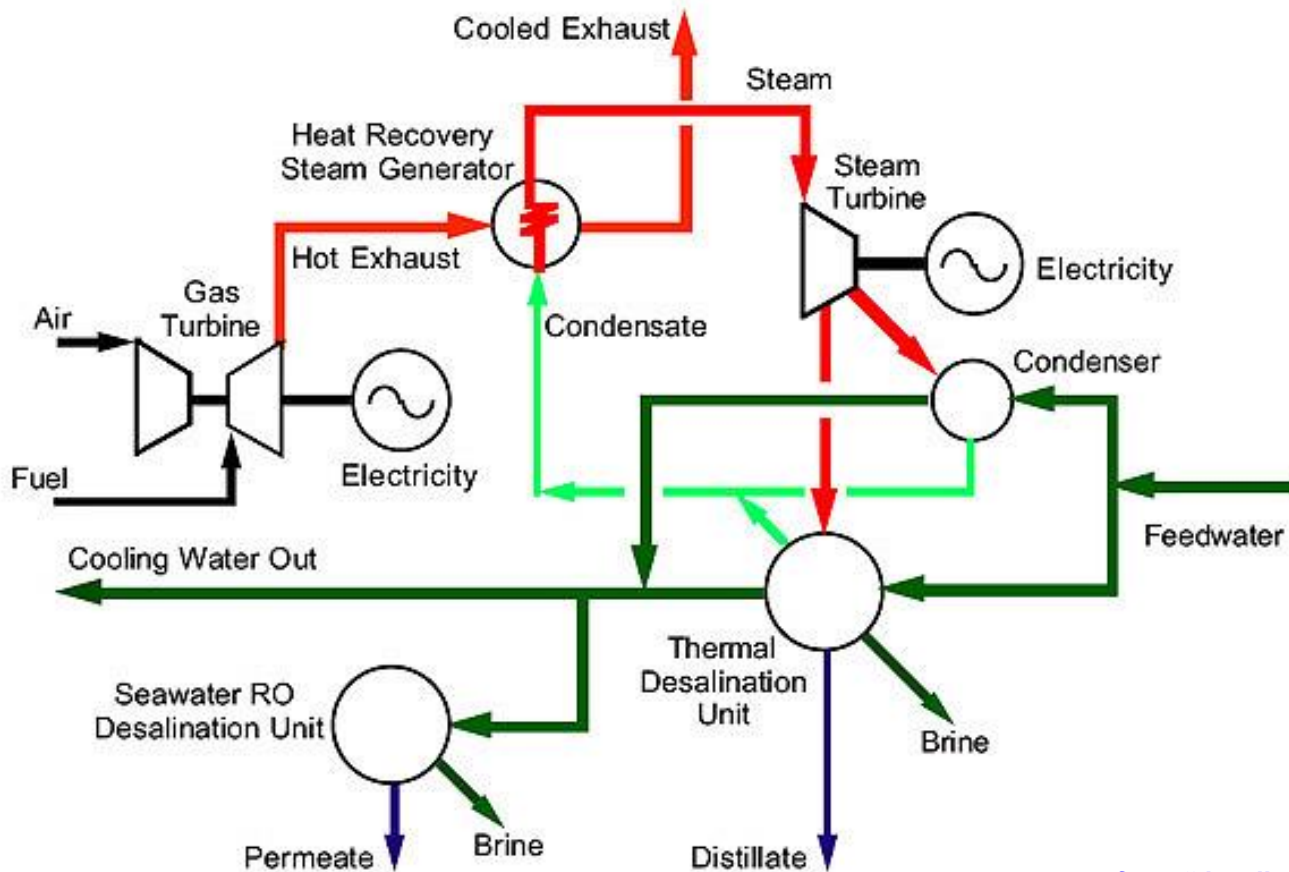
# Profile: MED with TC

<b>Location</b>	<b>Bahrain</b>
<b>Total Production</b>	<b>43,000 m<sup>3</sup>d</b>
<b>Number Units</b>	<b>4</b>
<b>Unit Capacity</b>	<b>10,750 m<sup>3</sup>d</b>
<b>Effects</b>	<b>4</b>
<b>Top Brine Temperature</b>	<b>62°C</b>
<b>Gain Output Ratio</b>	<b>7.5</b>
<b>Feedwater TDS</b>	<b>45,800 mg/L</b>
<b>Concentration Factor</b>	<b>1.48</b>
<b>Feedwater Temperature</b>	<b>33°C</b>
<b>Steam (TC + Ejectors)</b>	<b>240 T/h</b>
<b>Heat Source</b>	<b>Coke calcining</b>
<b>Total Seawater Supply</b>	<b>13,9200 m<sup>3</sup>h</b>
<b>Electrical Consumption</b>	<b>1.25 kWh/m<sup>3</sup></b>
<b>Startup Date</b>	<b>2002</b>





# Trend: Hybridization



from "desalination.com"



# Profile: MSF / RO Hybrid

<b>Location</b>	Fujairah UAE
<b>Total Production</b>	454,000 m <sup>3</sup> d
<b>Capacity: MSF / RO</b>	62.5% / 37.5%
<b>Units: MSF / RO</b>	5 / 17
<b>SWRO: Recovery</b>	41%
<b>MSF: TBT / GOR</b>	109°C / 7.5
<b>MSF: Steam Flow</b>	302 T/h @ 3.3 b
<b>Feedwater TDS</b>	40,000 mg/L
<b>Feedwater Temperature</b>	22° to 33°C
<b>Staff: Power/MSF/RO</b>	87 / 22 / 15
<b>Total Power Production</b>	660 MW
<b>Net Power Production</b>	500 MW
<b>Total Seawater Supply</b>	140,000 m <sup>3</sup> h
<b>Electrical Consumption</b>	6.98 kWh/m <sup>3</sup>
<b>Startup Date</b>	2003/2004







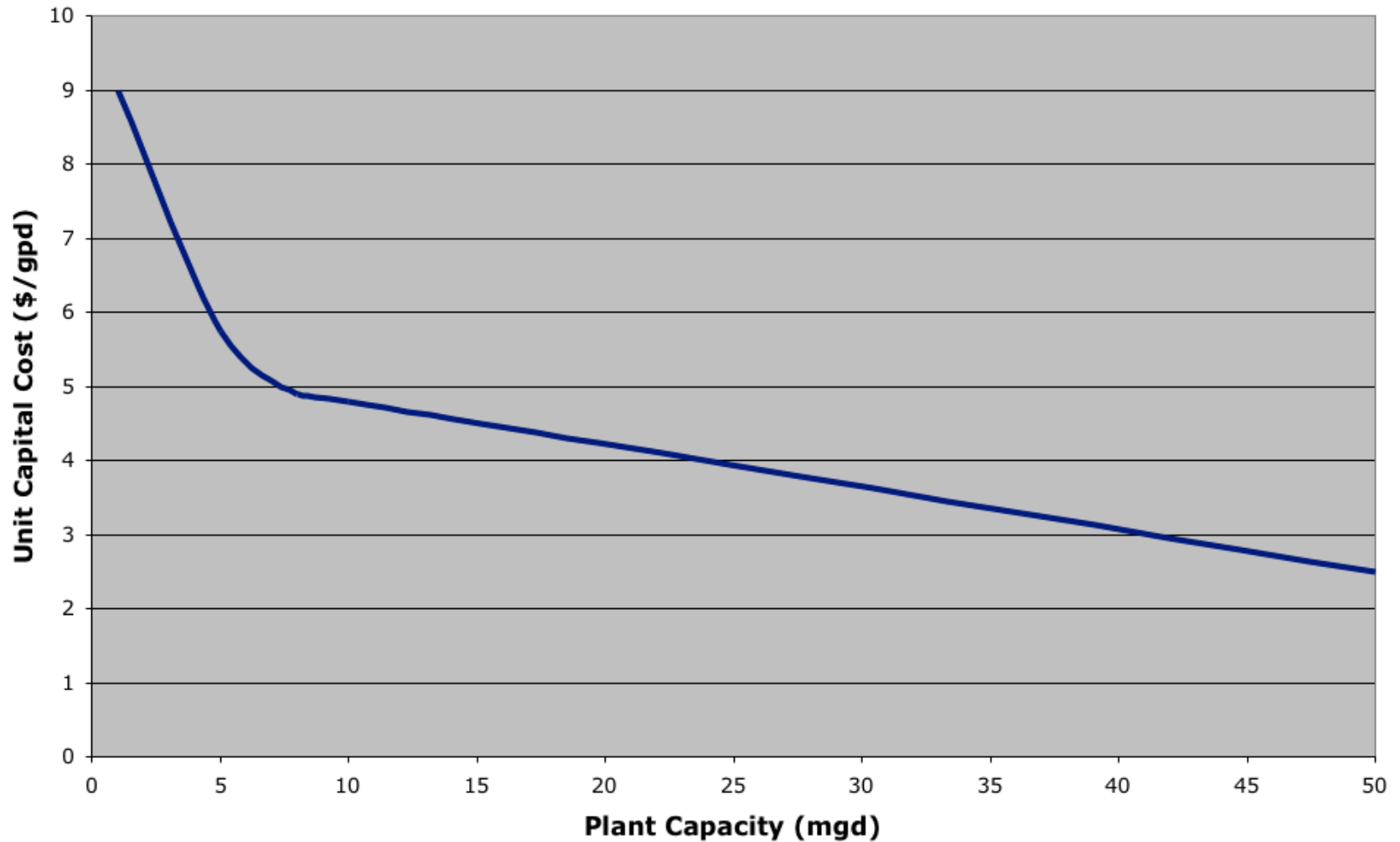
# Trend: Workshop Assembly





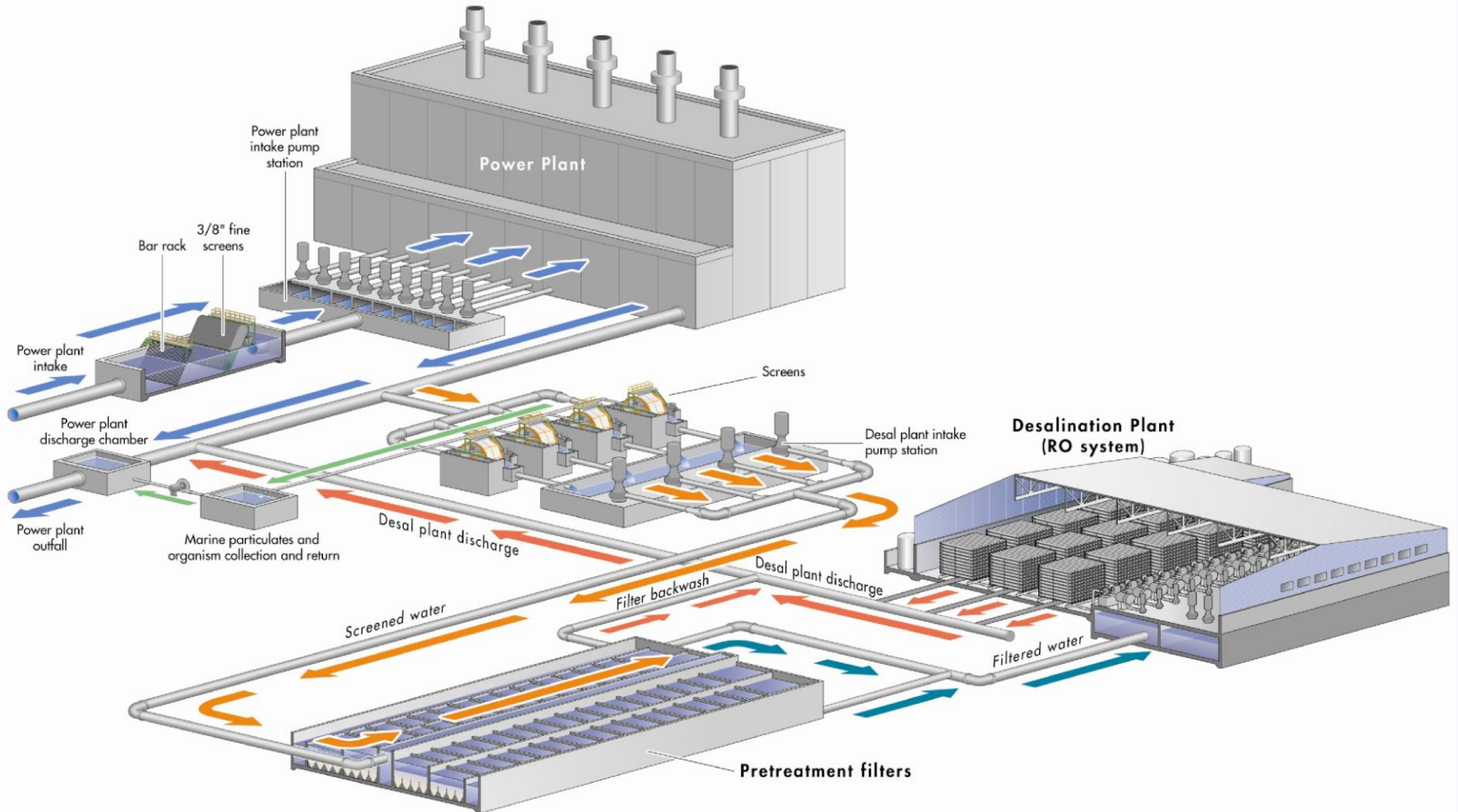


# Trend: Larger Plants



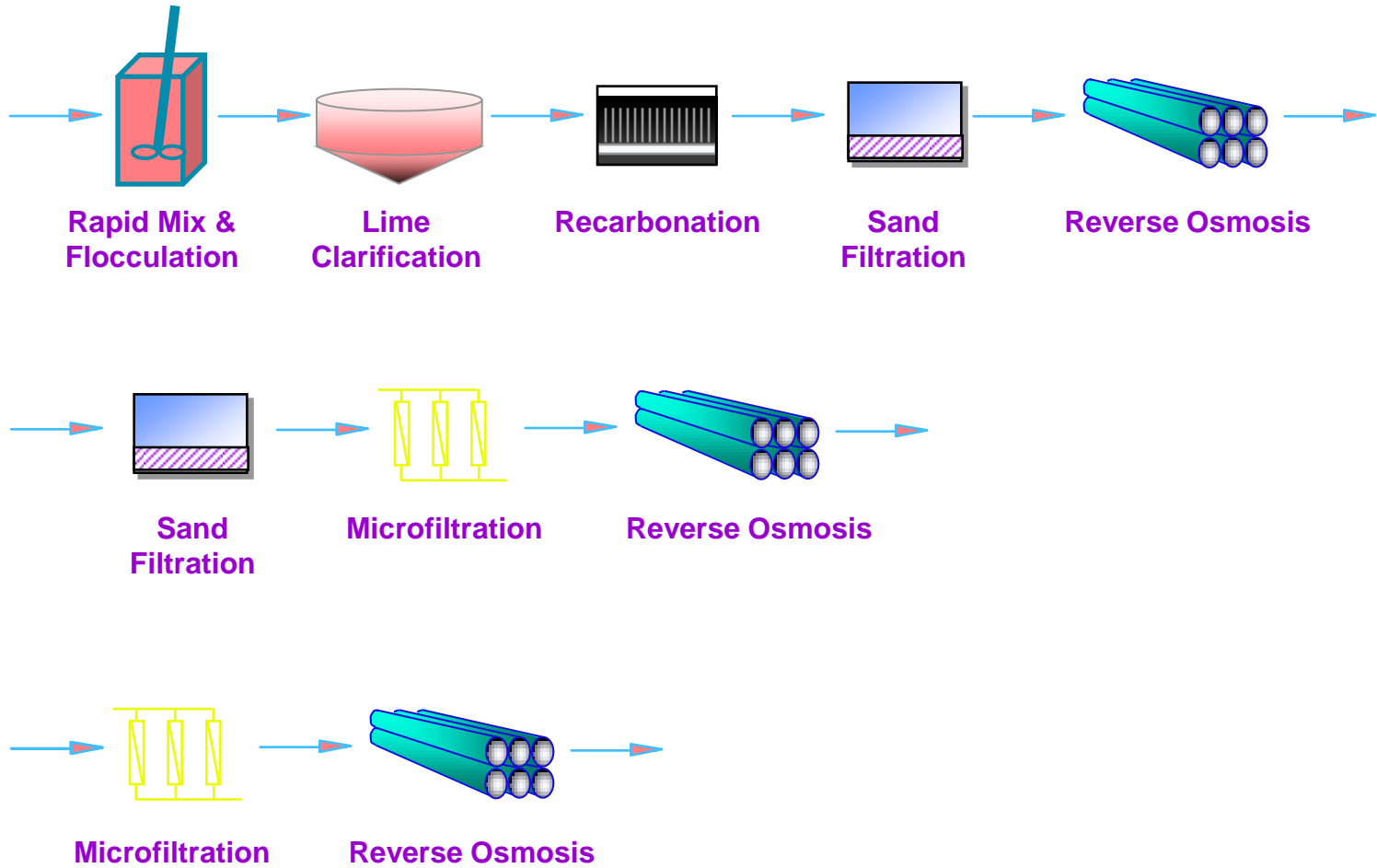


# Trend: Co-location





# Trend: Membrane Pretreatment

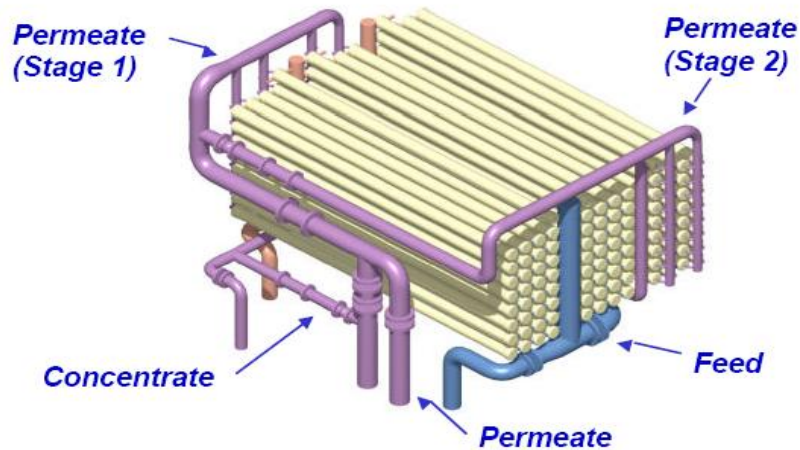




## Trend: Design Innovations

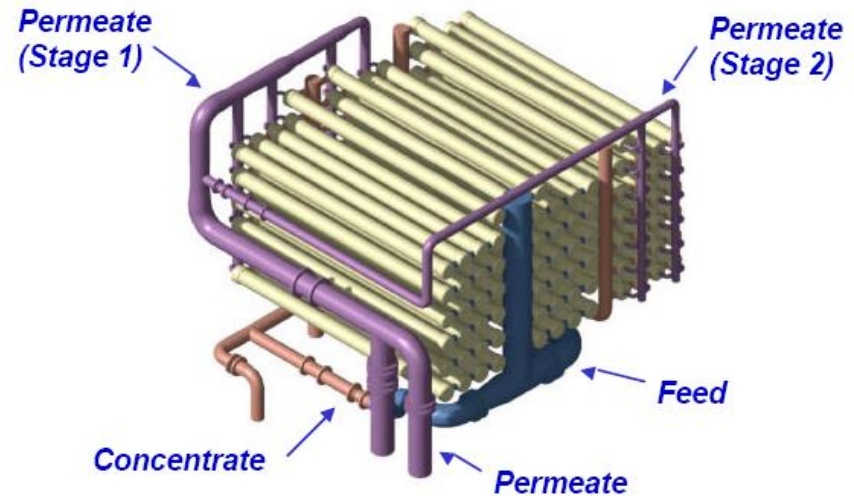
- 8M vessels
- Split permeate
- Hybrid vessels using range of permeable membranes
- Centralised pumping and energy recovery

# Trend: Large Diameter Membranes

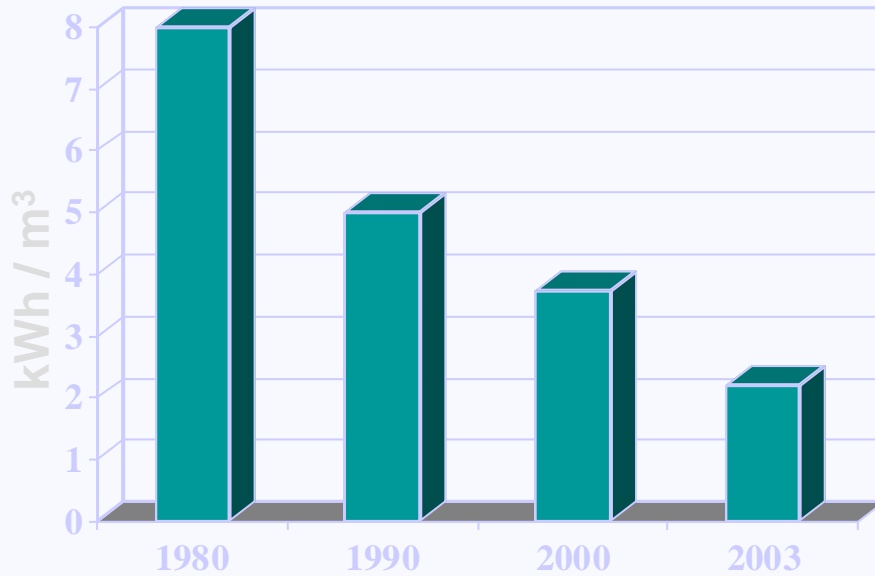


8-inch  
Train-size: 4.17 mgd  
Vessels: 99 Footprint:  
588 ft<sup>2</sup>

16-inch  
Train-size: 12.5 mgd  
Vessels: 75  
Footprint: 1015 ft<sup>2</sup>



# Trend: Increased Energy Efficiency

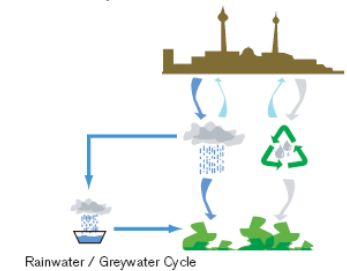
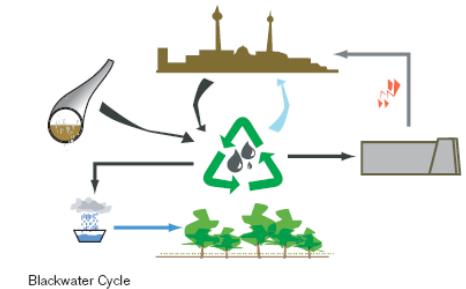
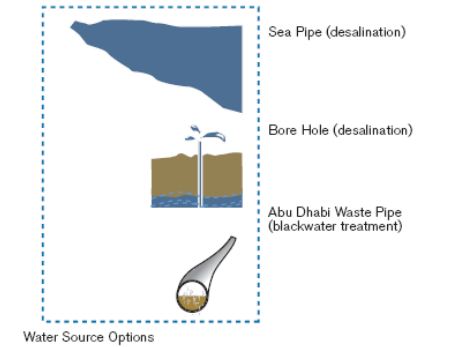
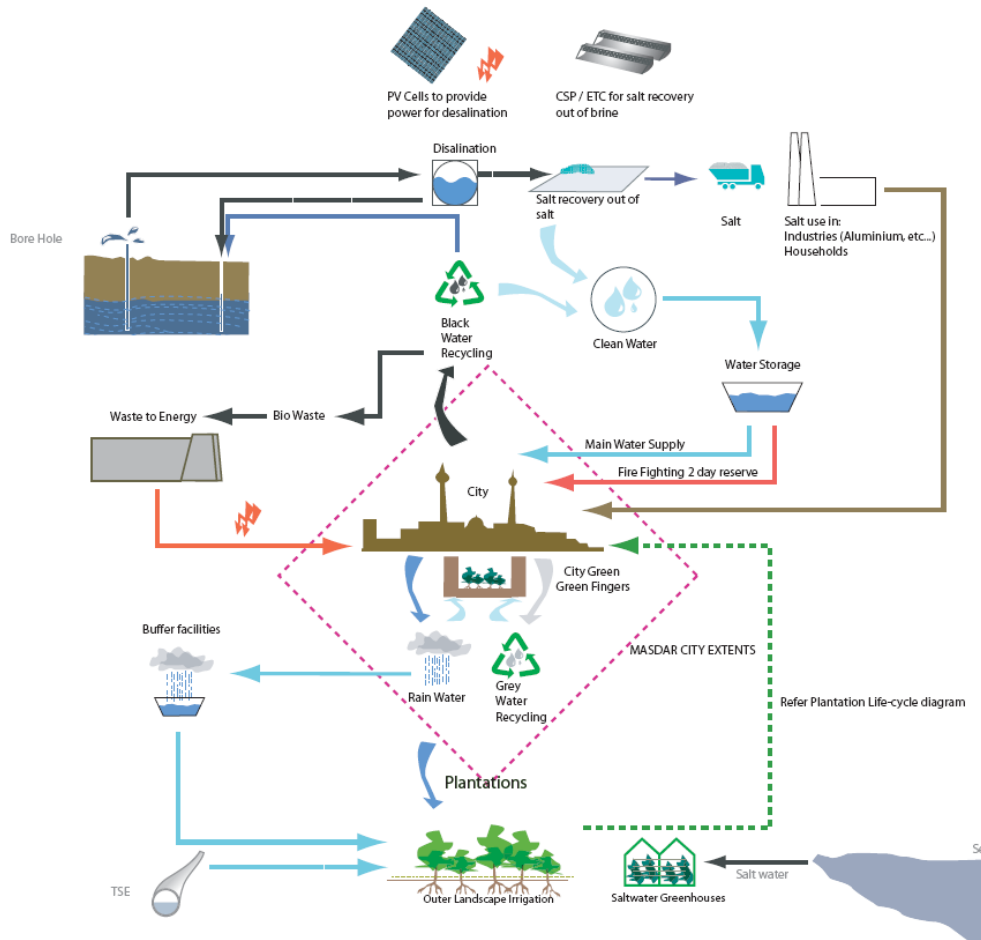


# Trend: Alternative Project Delivery



- Most projects employ a PPP
- PPP goals reflect desal project requirements
  - ▶ private sector development, technical, cost risk
  - ▶ expedited schedule
  - ▶ access to new technology, private capital
- Many local variations
  - ▶ IWPP in Middle East
  - ▶ Alliance contract in Australia
  - ▶ BOO rather than BOT in Caribbean
  - ▶ public ownership & finance in USA
  - ▶ local government corporation in Texas

# Trend: Membranes to Create Sustainability







# MASDAR City





# Thank You