

# **Multi-State Salinity Coalition**

## ***2010 Annual Summit***

### **Desalination 2010 - A Global Perspective and Trends**

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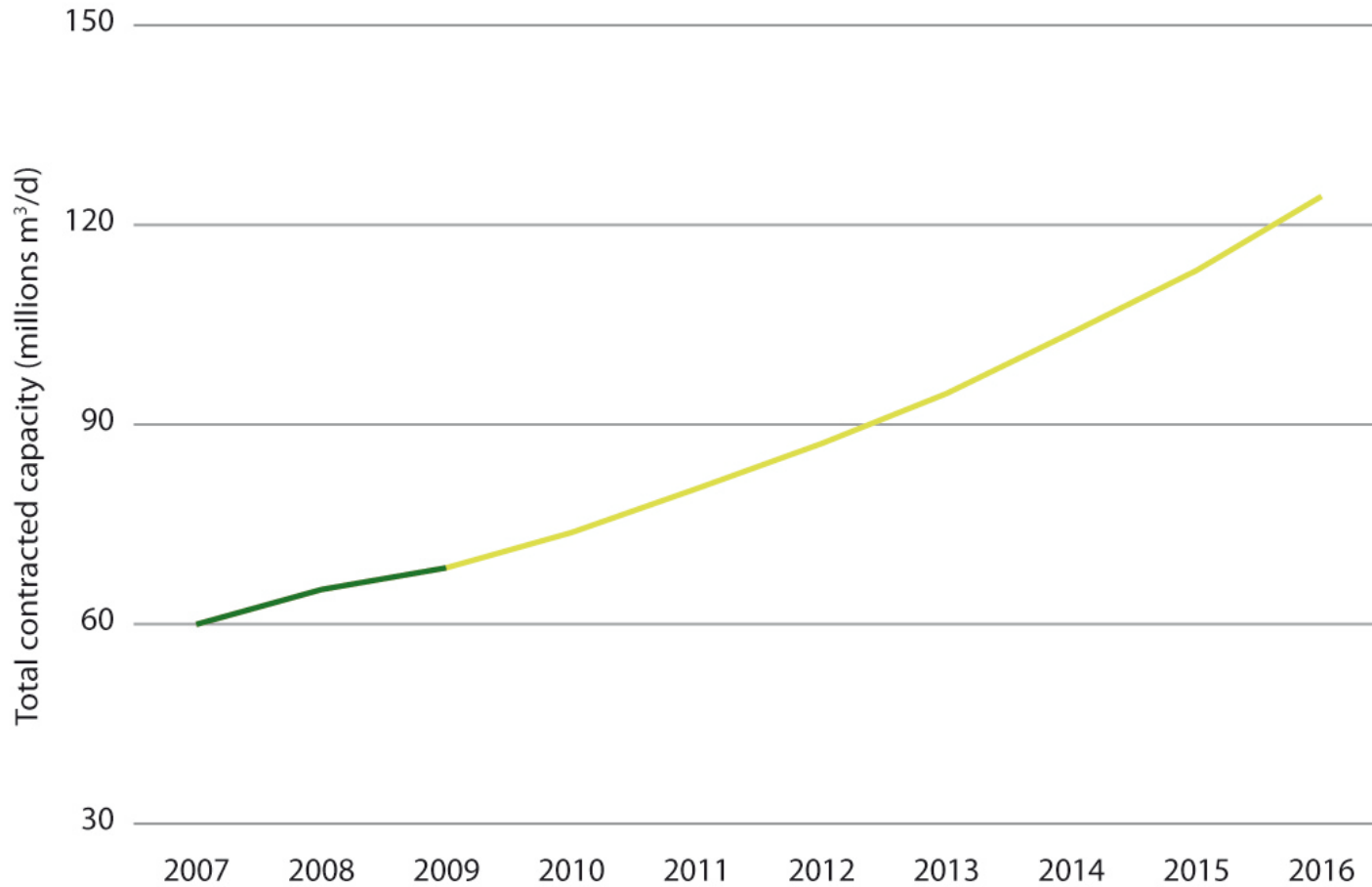
**Sr. VP, Water Standard**

**Immediate Past President, International Desalination Association**



# Desalination growing at a record rate

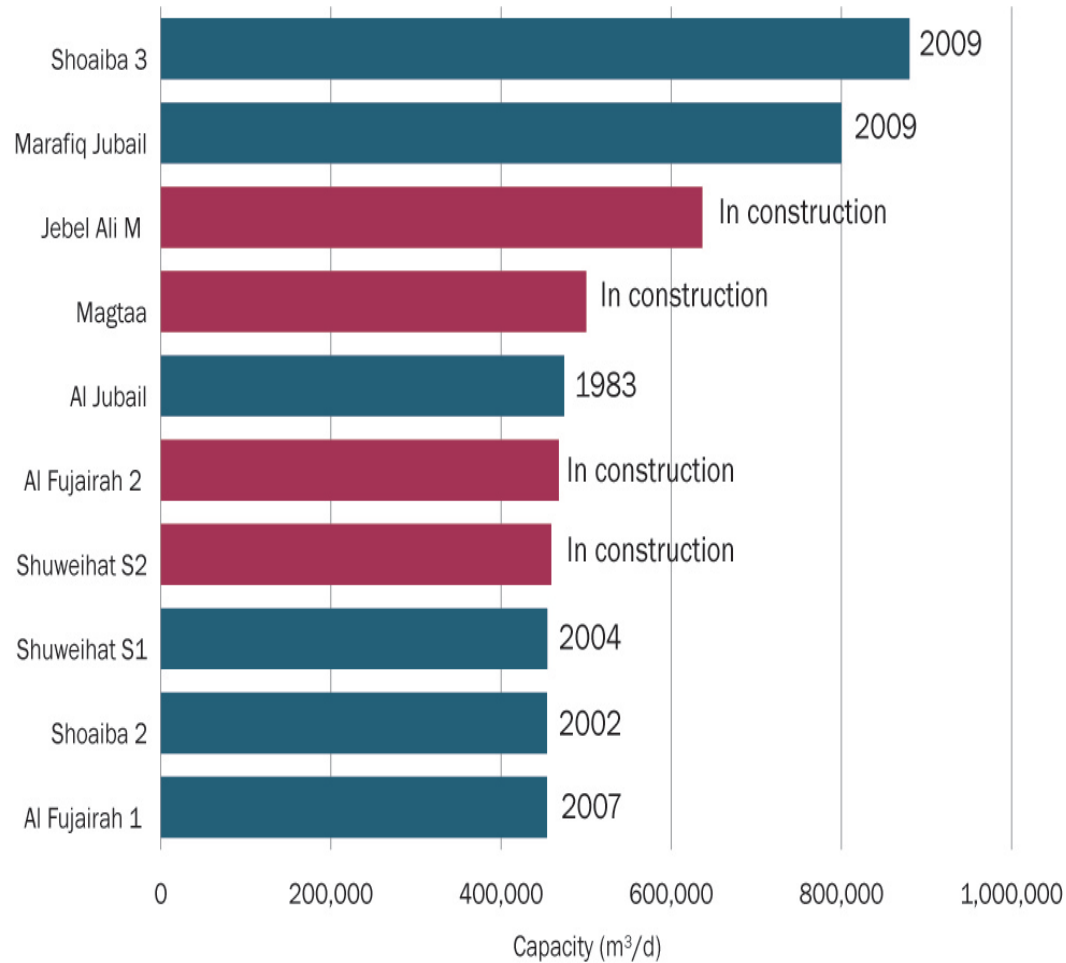
- 14,451 desalination plants with a combined capacity of 59.9 million m<sup>3</sup>/d (15.8 billion gal/d) now on-line in 150 countries
- 12.3% increase over last year
- A further 244 plants with a capacity of 9.1 million m<sup>3</sup>/d (240 million gal/d) are known to be under contract
- More plants with more capacity have been brought on-line during the past year than ever before



Source: GWI DesalData/IDA



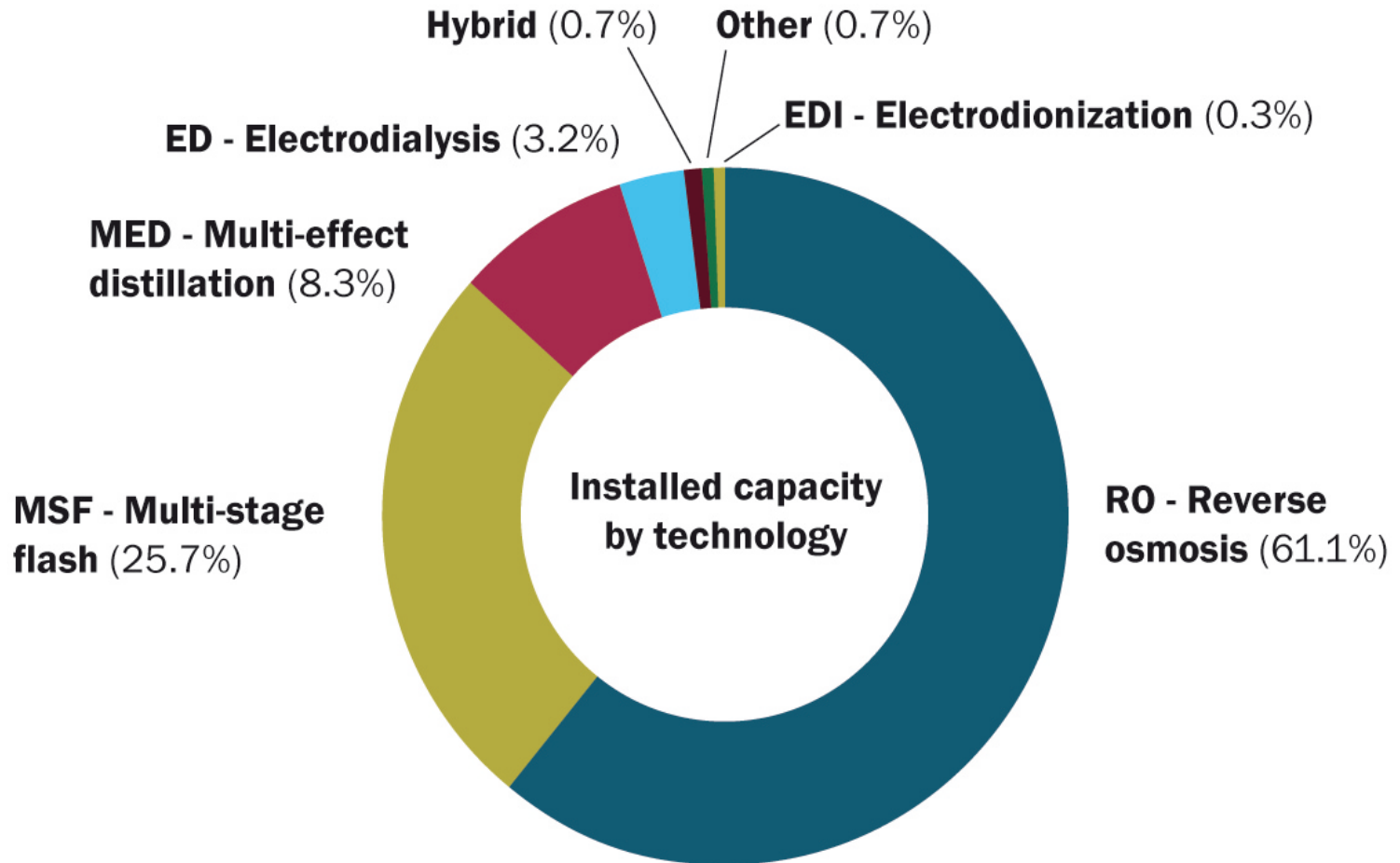
# Capacity of largest plants



Source: GWI DesalData/IDA



# Technology type



Source: GWI DesalData/IDA



# Global trends in desalination

- Energy efficiency
- Environmental considerations
- Increase in plant size
- Privatisation of desalination projects
- Reduction in cost of desalination



# Energy efficiency

- A primary driver in technology and design/operating parameter selection
- Push toward more efficient desalination technologies such as reverse osmosis for seawater
  - RO growth: 18%/yr vs. MSF/MED growth: 11%/yr
  - Energy recovery dropping SWRO energy consumption below 3 kWhr/m<sup>3</sup> (11.4 kWhr/1000 gal)
  - Energy efficiency driven partially by GHG emissions concerns but also cost of power in general



# Environmental considerations

- Important in site selection, power source and technology/design choices
- GHG emissions a primary driver in some regions: Australia and the U.S.
- Impingement and entrainment concerns
- Concentrate disposal: salinity and temperature impacts
- Other chemical impacts





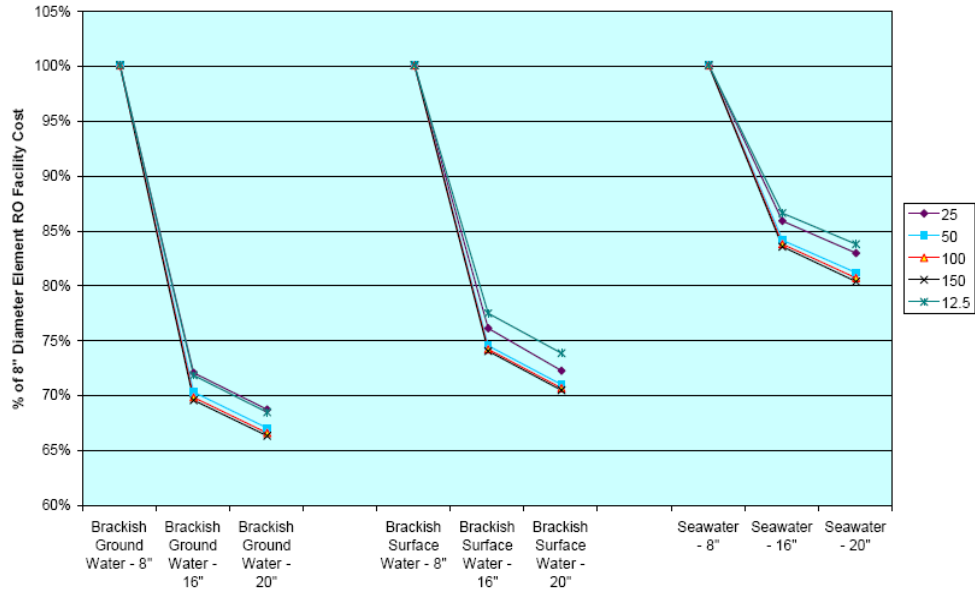
# Increasing size of projects

- Rapidly increasing
- Economy of size opportunities
  - Large unit capacity MSF and MED units
  - Large diameter RO elements/vessels
    - Israeli Soreq plant - 411,000 m<sup>3</sup>/d (108.5 Mgd) award in 2010 reducing number of RO elements from approximately 52,500 to less than 12,200 (WDR 46,2)
  - Large capacity energy recovery units
  - Ras Azzour 1,025,000 m<sup>3</sup>/day (270 Mgd) of capacity



# Large diameter RO

RO Facility % of 8" Diameter Elements



Henthorne et al, IDA 2005





# Privatization

- 38% of desalination plant capacity constructed since 2002 has been privately financed
- Privatisation of desalination began in the Caribbean; instituted in Abu Dhabi in early 2000's.
- Movement throughout the GCC toward privatisation of both power and desalination



# Cost reduction

- Cost depends on multiple factors
  - Capital expenditures
  - Operating costs
    - Cost of power
- Success in reducing operating costs
  - Typically in the range of \$0.40-0.90/m<sup>3</sup>



# Lower RO flux

	Case 2 – 13 oC (9.43 gfd)	Case 2A – 13 oC (8.32 gfd)
<b>Consumed Power</b>	<b>11,313 kW</b>	<b>10,350 kW</b>
<b>No of 1<sup>st</sup> pass trains</b>	<b>6 off</b>	<b>6 off</b>
<b>1<sup>st</sup> Pass train size</b>	<b>100 PV's</b>	<b>108 PV's</b>
<b>1<sup>st</sup> Pass vessel rating</b>	<b>1200 psi</b>	<b>1000 psi</b>
<b>No of 2<sup>nd</sup> Pass trains (2 running)</b>	<b>4</b>	<b>4</b>
<b>2<sup>nd</sup> Pass train size</b>	<b>63 PV's</b>	<b>59 Pv's</b>
<b>2<sup>nd</sup> pass vessel rating</b>	<b>450 psi</b>	<b>450 psi</b>
<b>Outlet Boron</b>	<b>0.26 ppm</b>	<b>0.27 ppm</b>

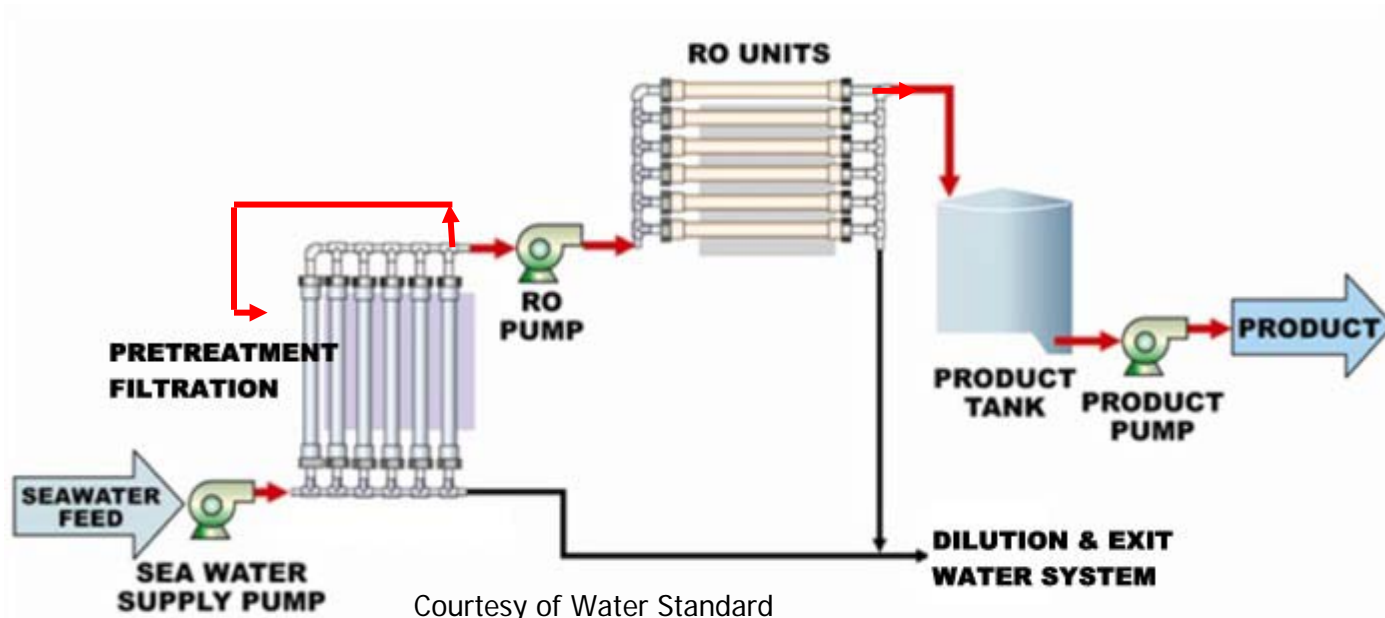
	Case 2	Case 2A
<b>1<sup>st</sup> Pass</b>		
<b>Vessels (est)</b>	$\$1300 \times 600 =$ <b>\$780,000</b>	$\$1100 \times 648 =$ <b>\$712,800</b>
<b>Membranes (est)</b>	$\$500 \times 4200 =$ <b>\$2,100,000</b>	$\$500 \times 4536 =$ <b>\$2,268,000</b>
<b>2<sup>nd</sup> Pass</b>		
<b>Vessels (est)</b>	$\$900 \times 252 =$ <b>\$226,800</b>	$\$900 \times 236 =$ <b>\$212,400</b>
<b>Membranes (est)</b>	$\$450 \times 1764 =$ <b>\$793,800</b>	$\$450 \times 1652 =$ <b>\$743,000</b>
<b>Additional Pipeworks</b>	<b>\$2,000</b>	<b>\$8,000</b>
<b>Estimated Total</b>	<b>\$3,902,600</b>	<b>\$3,944,200</b>





# Straight-through pumping

- Utilize membrane filtration
- Eliminate filtrate tank
- Eliminate cartridge filters
- Eliminate HP booster pump through cartridge filters



Courtesy of Water Standard





# Why is seawater desalination growing so fast? (except in US)

- Over exploitation of non-renewable groundwater resources means that less water is available, but demand continues to grow.
- Water tends to be most heavily subsidised where least is available. Too little effort goes into demand management.
- Explosion of demand in the GCC region due to population growth and relatively high oil prices.
- Major expansion of desalination in Algeria, Spain and Australia; new markets opening in China, India, and the US.
- Seawater is a guaranteed supply.
- Affordability versus alternatives has improved.



# Thank You