

**INTERNATIONAL  
CONFERENCE ON  
DESALINATION AND  
SUSTAINABILITY**

1 - 2 March 2012



الجمعية المغربية للمياه و تحلية المياه



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# Overview & Trends of Membrane Desalination Technology & Privatization in the Mena Region

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MOR12-008



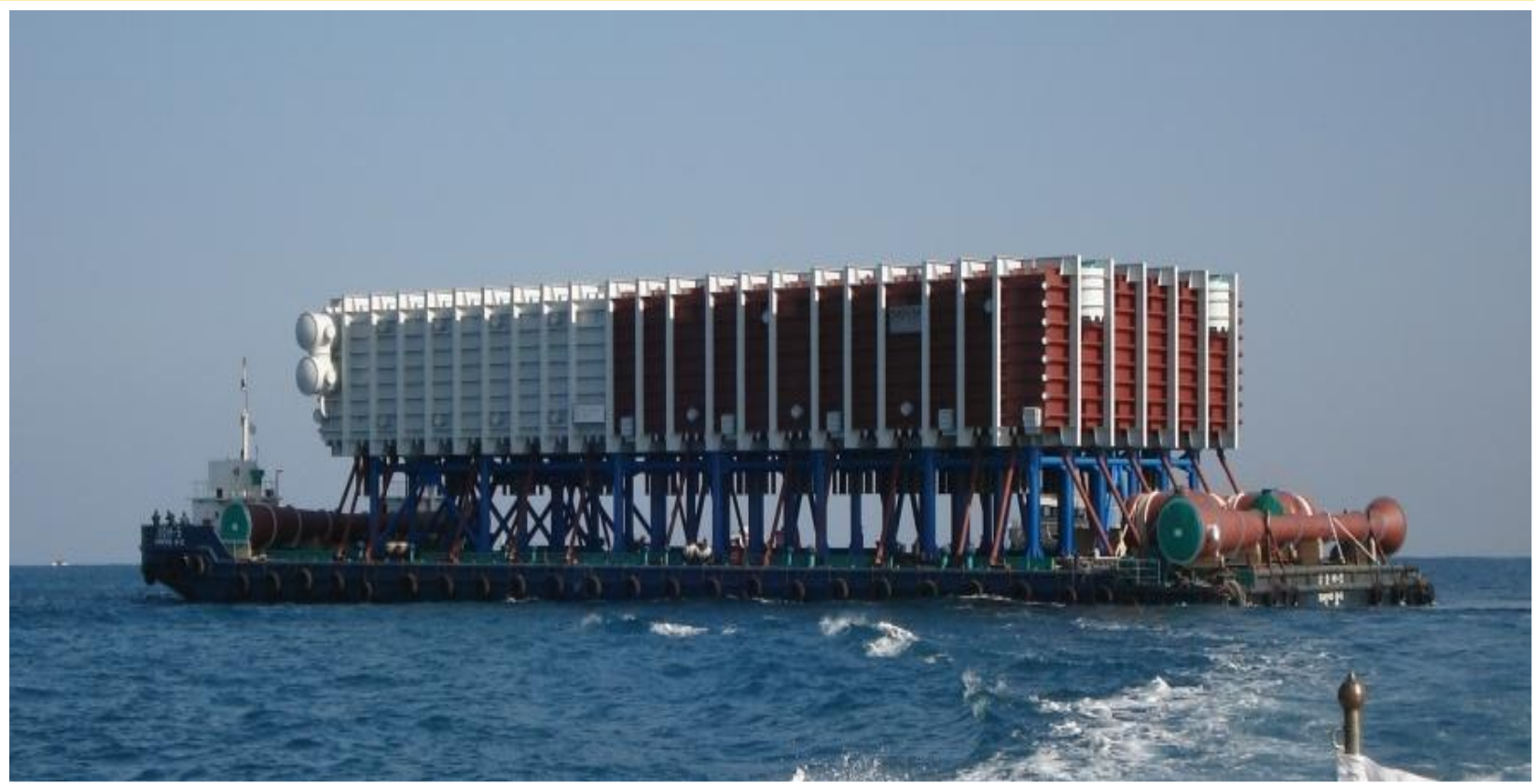
## STATUS OF DESALINATION IN MENA

- Arab countries produce about 2.25 million m<sup>3</sup>/day of desalinated water via membrane processes, with 4-6 million m<sup>3</sup>/day under construction or planning.
- Saudi Arabia is the world's largest producer of desalinated water (*7.6 million m<sup>3</sup>/day total, including 1.07 million m<sup>3</sup>/day RO*).
- Focus on MED & SWRO desalination processes due to improvements in technology, efficiencies, unit capacities, energy utilization and cost.





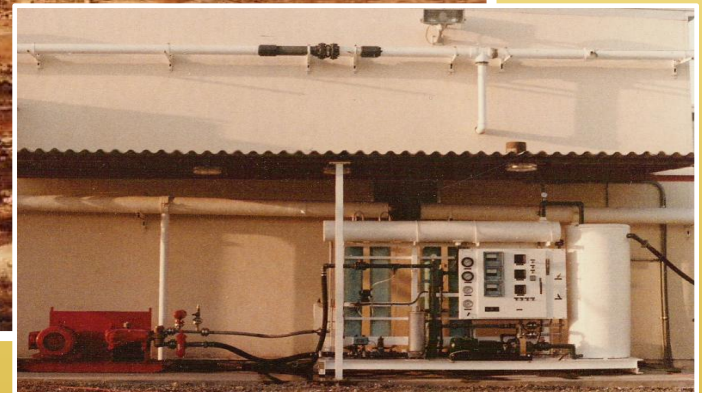
## One of 12 Fujairah 2 IWPP'S MED Units





## SWRO – WHERE IT ALL STARTED

*Ghar Lapsi's 20,000 m<sup>3</sup>/day SWRO Plant, Malta, 1983*





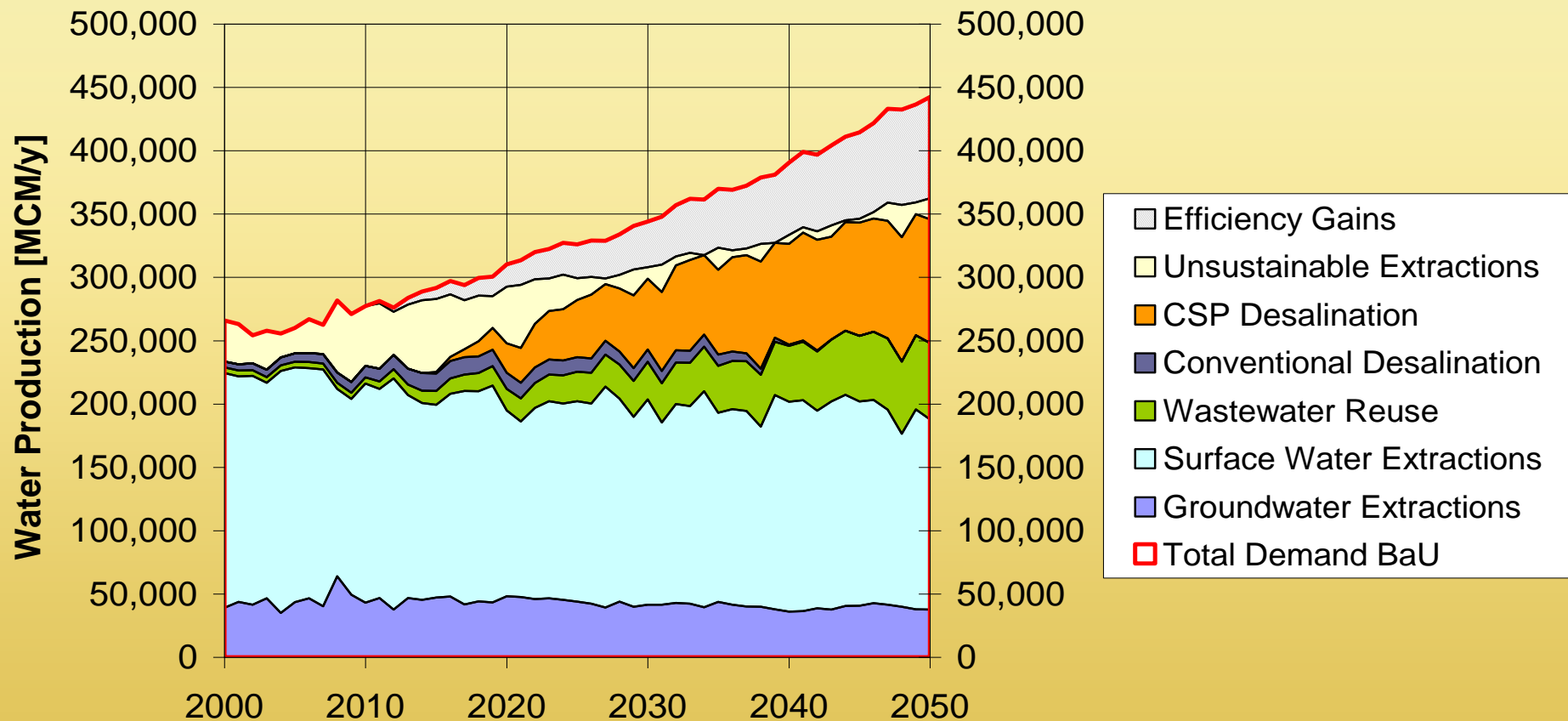


## STATUS OF DESALINATION IN MENA

- Large scale privatized desalination/power projects becoming standard (Algeria, Saudi Arabia, UAE, Kuwait, Bahrain, Oman, Qatar).
- Arab countries will spend \$30-40 billion through 2025 on new plants; \$40 billion already spent by GCC.
- Large-capacity mobile desalination now feasible to address acute and chronic regional water shortage and emergency supplies.
- Green desalination being more developed with environmental awareness and stricter regulations.



## Middle East & North Africa (MENA)



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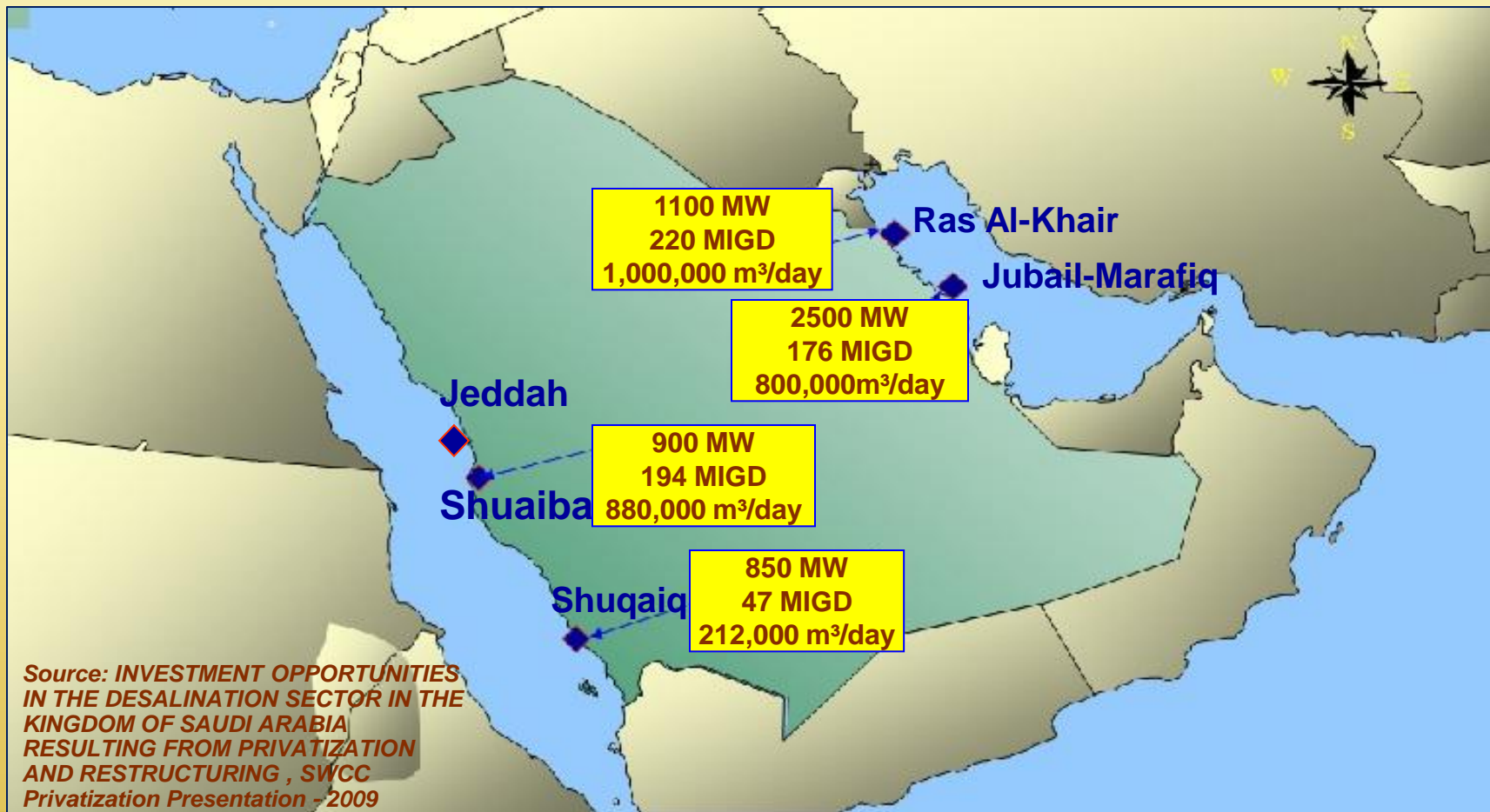
DESALINATION AND SUSTAINABILITY

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No.	PLANT	LOCATION	RO CAPACITY ( $m^3/day$ )
1	Mactaa	Oran – Algeria	500,000
2	Hamriyah	UAE	455,000
3	Soreq	Israel	411,000
4	Salibiyah	Kuwait	375,000
5	Hadera	Israel	347,000
6	Ad Dur IWPP	Bahrain	321,000
7	Ashkelon	Israel	274,000
8	Shuqaiq IWPP	Saudi Arabia	212,000
9	Jeddah III	Saudi Arabia	200,000
10	Hamma	Algeria	200,000
11	Mostagane	Algeria	200,000
12	Fujairah I IWPP*	UAE	170,500
13	Shuaiba Expansion IWPP	Saudi Arabia	150,000
14	Fujairah II IWPP	UAE	136,500
15	Rabigh IWPP	Saudi Arabia	134,000



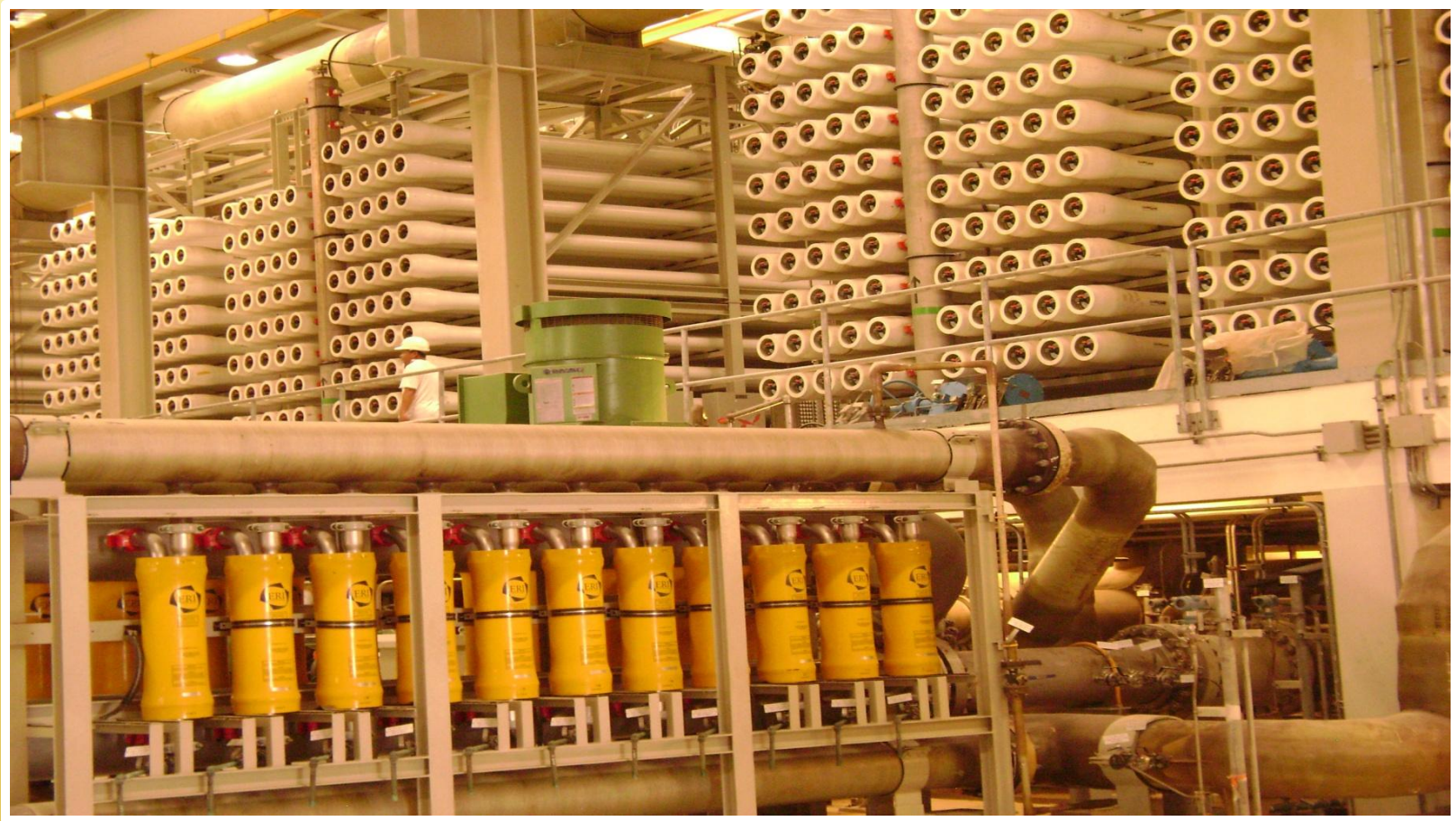
## Sites of KSA's IWPP Plants







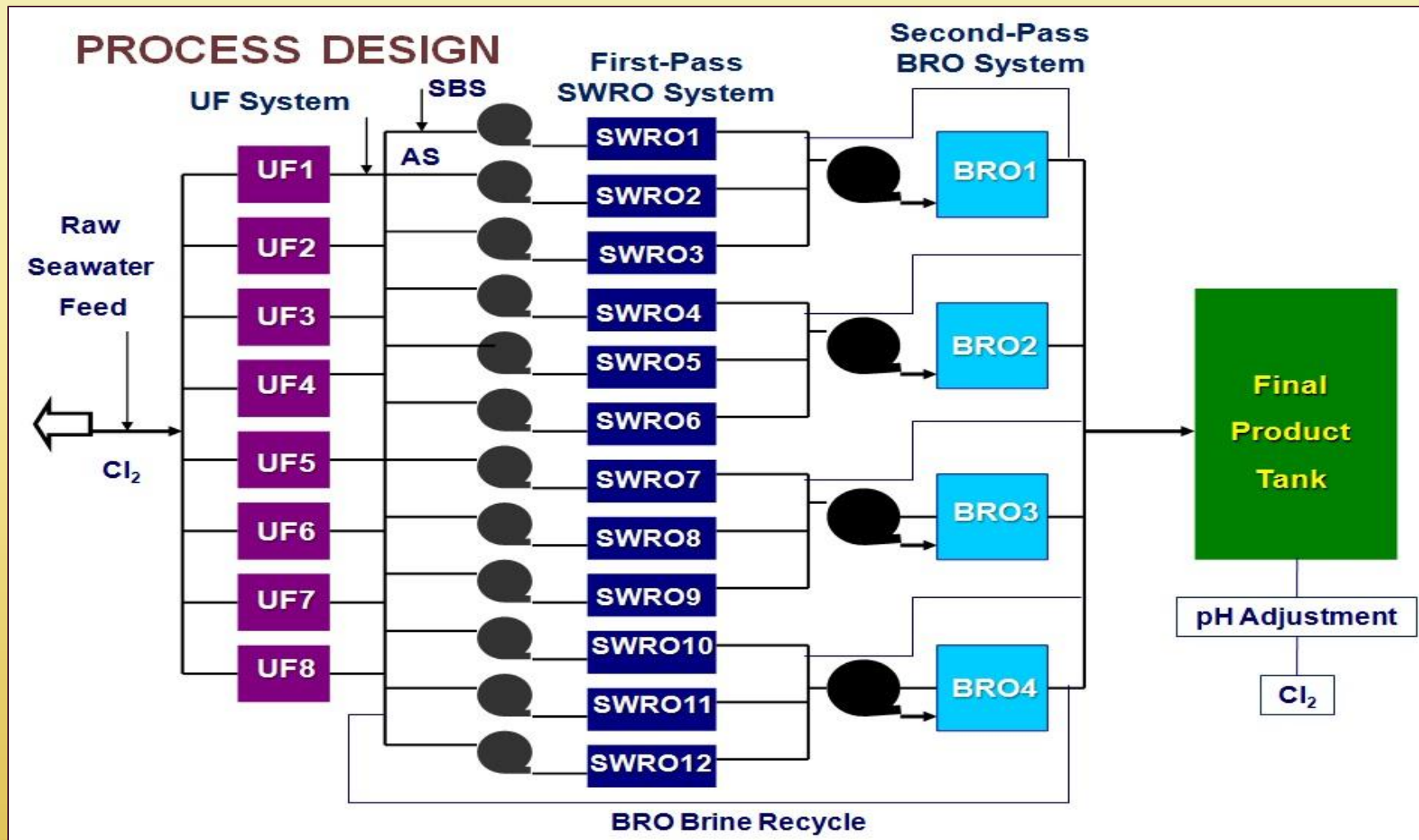
## Shuaiba IWPP Expansion SWRO Trains





## Barges SWRO Mobile Desalination IWP









## SWRO Major Issues

- **Water Cost**
- **Energy Efficiency (*energy recovery devices*)**
- **Pretreatment Efficacy & Integration (*UF/SWRO*)**
- **Membrane Fouling (*Organic/Biological*)**
- **Recovery Ratio (*45-60%*)**
- **Permeate Quality (*single vs. double-pass*)**



## SWRO Major Issues

- **Unit Capacity** (*Large diameter membrane elements*)
- **Environmental friendliness & compliance**  
(*use of chemicals, marine life impact, noise pollution*)
- **Hybrid desalination with renewable energy sources**  
(*SWRO/MED & CSP/CPV*)
- **Footprint**  
(*important to solar and mobile desalination*)



# SWRO Desalination Cost

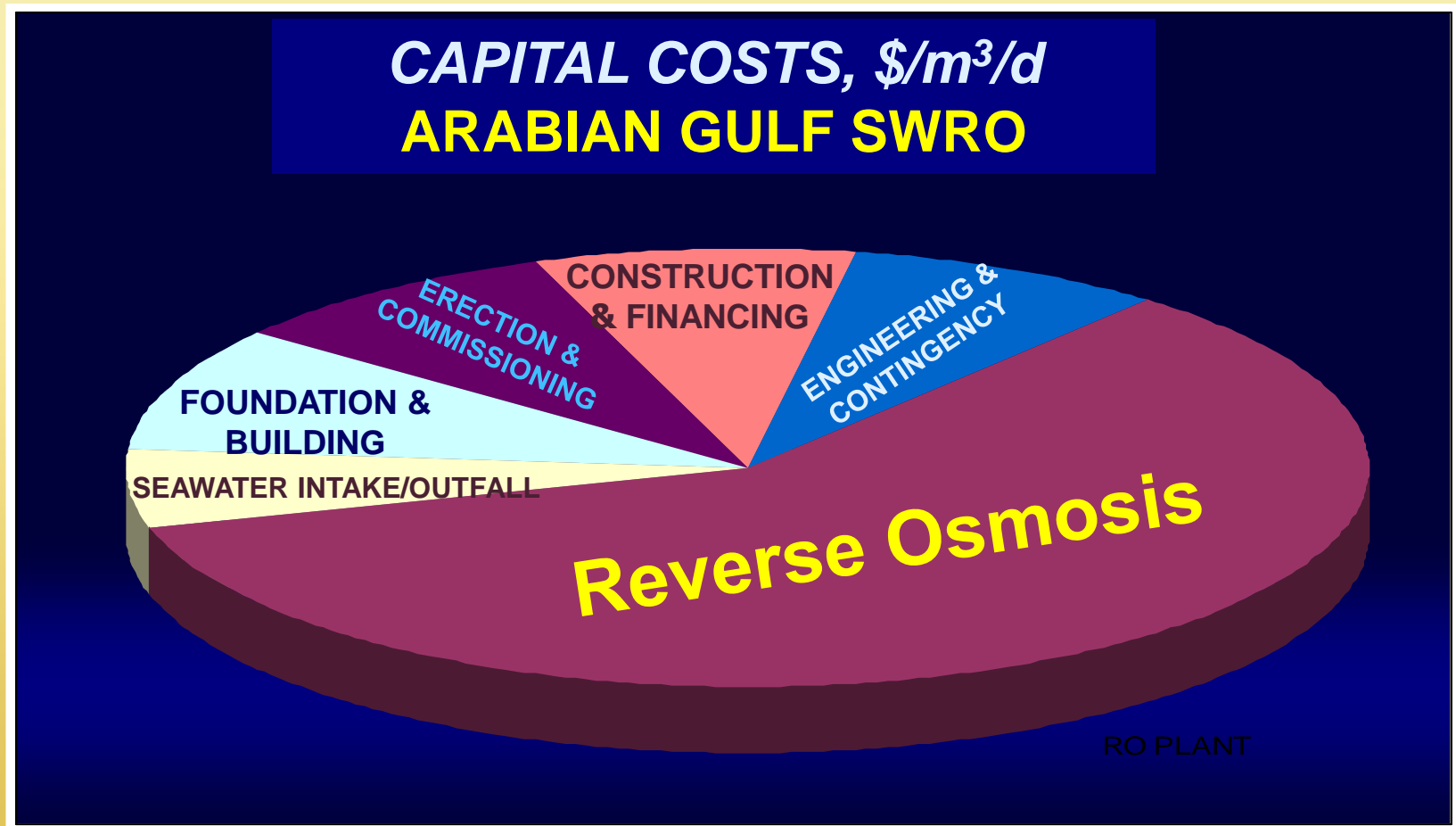
## TOTAL WATER COSTS

CASE	MEDITERRANEAN	RED SEA	RED SEA	ARABIAN GULF	ARABIAN GULF
<i>Capacity, M3/D</i>	<i>20,000</i>	<i>1,000</i>	<i>45,000</i>	<i>20,000</i>	<i>90,000</i>
CAPITAL COSTS, \$1000	\$11,767	\$796	\$18,491	\$11,537	\$37,412
O&M, \$1,000	\$3,949	\$238	\$5,596	\$2,774	\$9,422
Amortization, \$1,000	\$2,284	\$186	\$4,263	\$2,889	\$8,966
TOTAL COSTS, \$1,000	\$18,000	\$1,220	\$28,350	\$17,200	\$55,800
US \$/M <sup>3</sup>	0.9	1.22	0.63	0.86	0.62
US \$/1,000 GAL	3.41	4.62	2.39	3.26	2.35

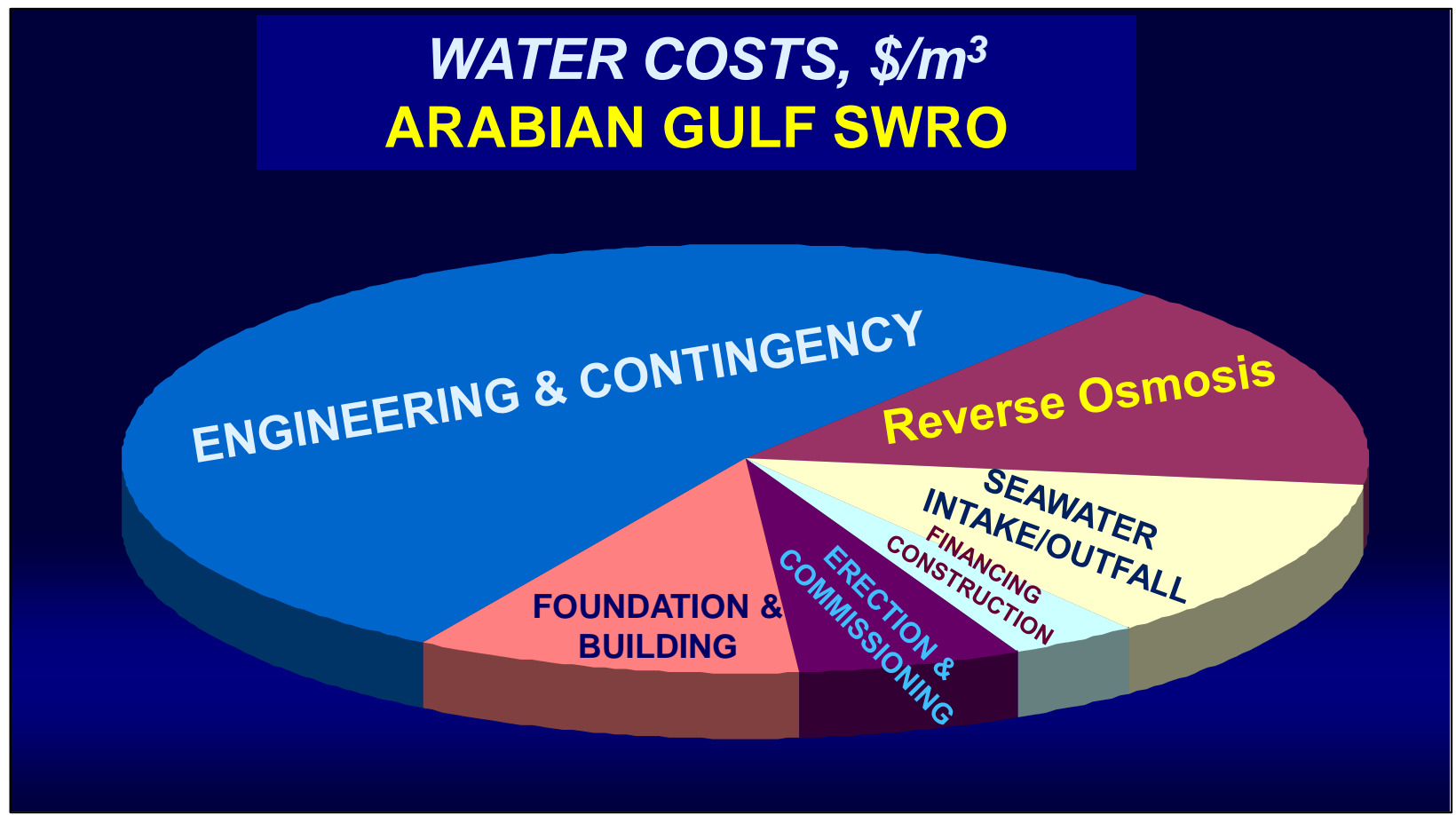




## SWRO Desalination Cost



## SWRO Desalination Cost





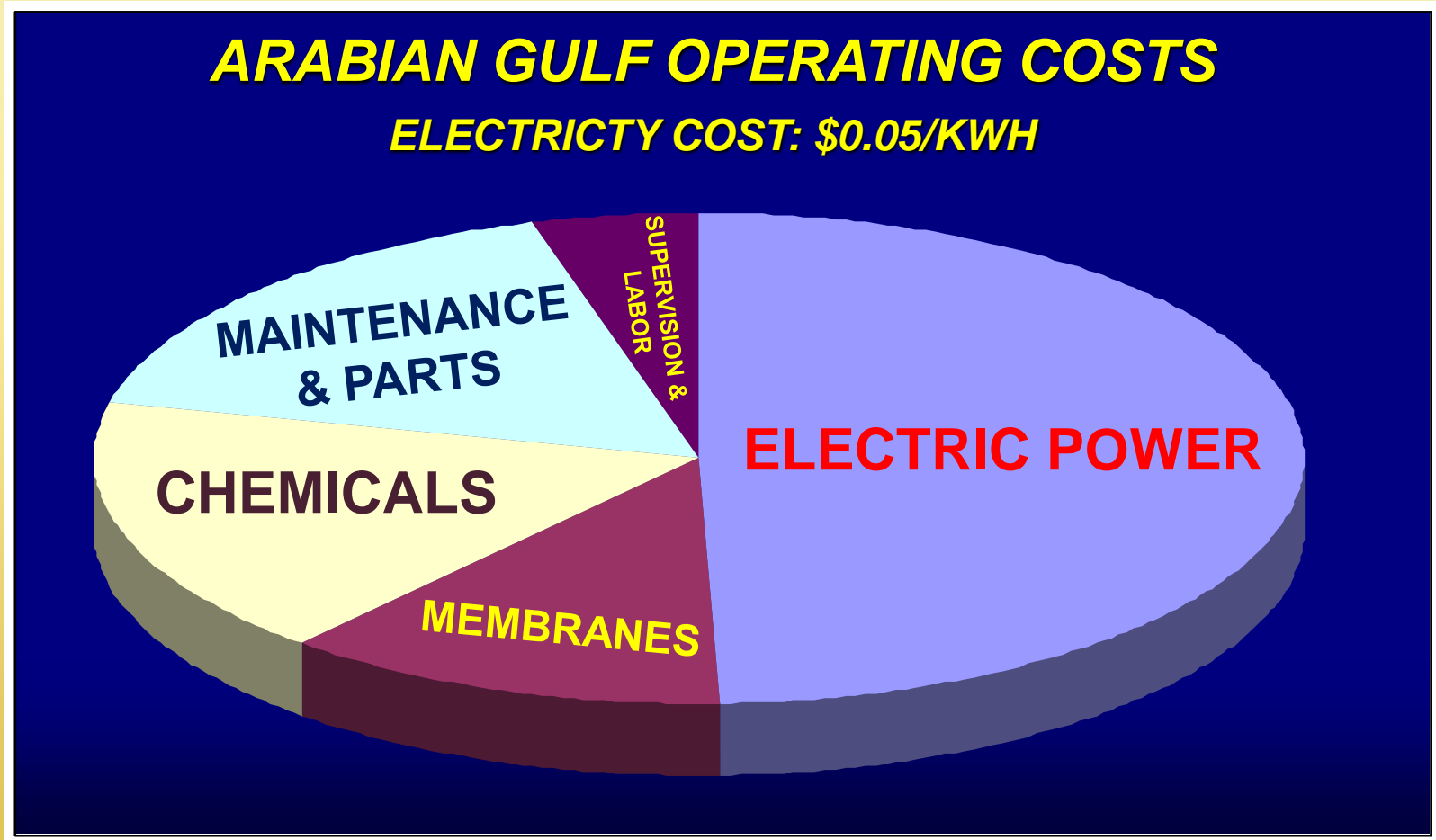
# SWRO Desalination Cost

## ❖ *Impact of Fuel Prices on Desalination Costs*

- 50-75% of SWRO O&M costs, and 25-75% of total water costs related to energy use, most impacted by fuel prices & feed salinity.
- HPP is the single most expensive piece of equipment in SWRO Plants.
- Two case studies: Arabian Gulf & Caribbean SWRO Plants.

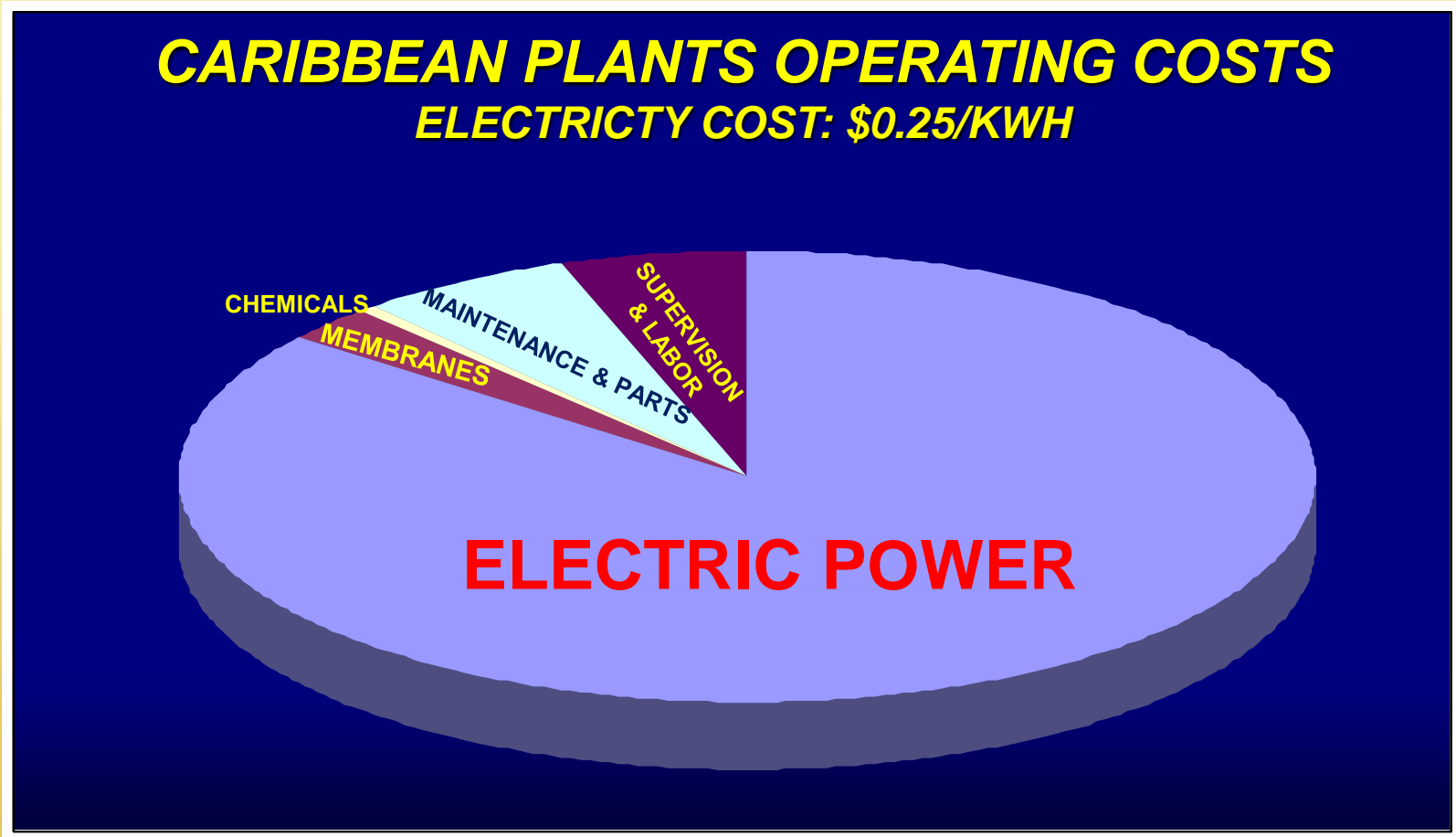


## ❖ *Impact of Fuel Prices on Desalination Costs*





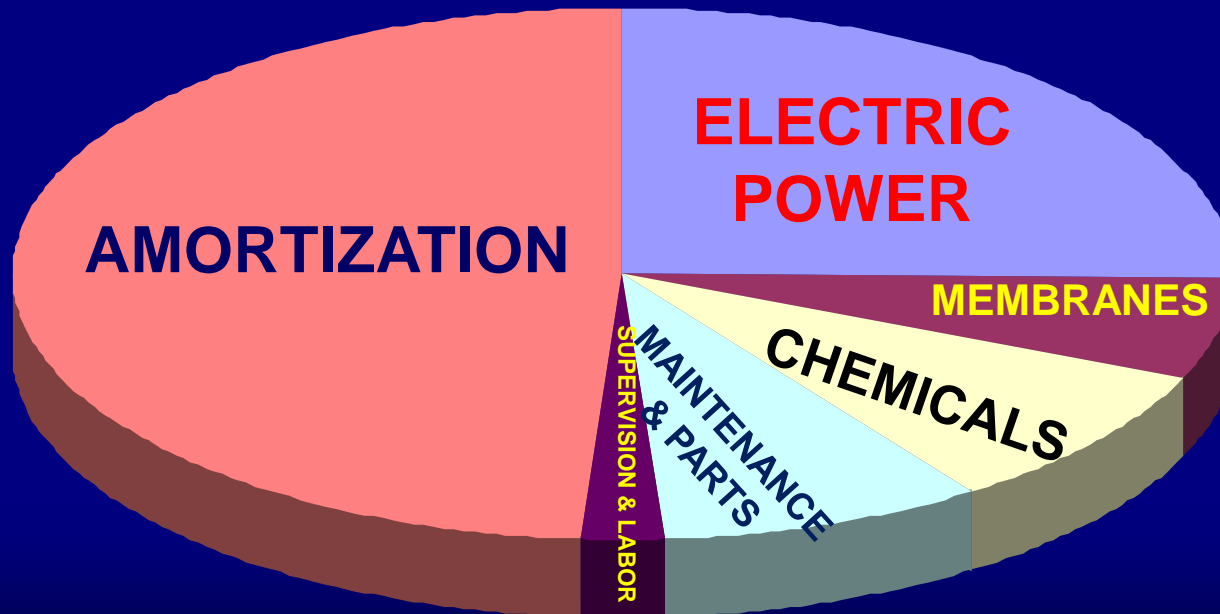
## ❖ *Impact of Fuel Prices on Desalination Costs*





## ❖ *Impact of Fuel Prices on Desalination Costs*

### **ARABIAN GULF PLANTS TOTAL WATER COSTS** **ELECTRICITY COST: \$0.05/KWH**

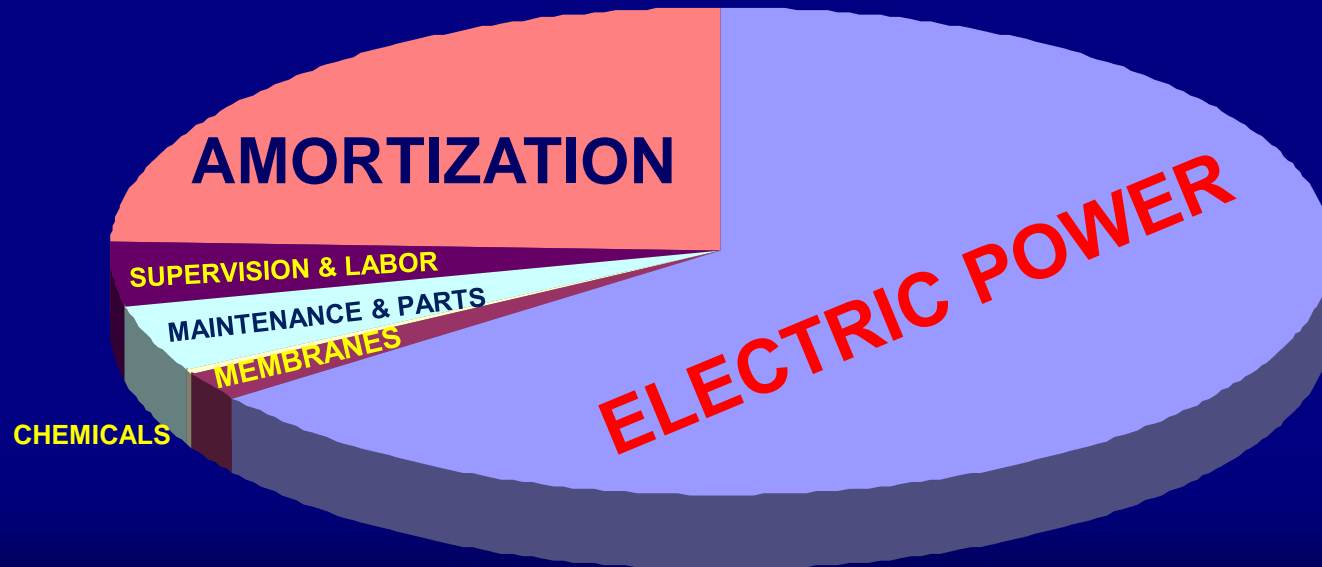






## ❖ *Impact of Fuel Prices on Desalination Costs*

### **CARIBBEAN PLANTS TOTAL WATER COSTS** **ELECTRICITY COST: \$0.25/KWH**





# WATER PRIVATIZATION

## • *CONCEPT & BENEFITS*

- Transfer of government assets and obligations to private sector to increase efficiency and meet rising water demand at affordable cost.
- Integrating power and water production.
- Spurring economic growth via participation of private sector competitiveness, partnerships, elimination of government subsidies and reducing manpower.
- Efficient utilization of technological advances and promoting transfer of technology and know-how between private companies, universities & R&D entities.



# WATER PRIVATIZATION

- ***MECHANISMS***

- Creation of institutional and legal framework.
- Establishment of key government organizations to facilitate and support privatization effort
- Restructuring of investment regulations and foreign ownership laws.
- Implementation of independent water & power projects (IWPP) on build, own & operate (BOO) basis.
- Transfer of government assets to private investors.
- Oman, UAE, Algeria, Saudi Arabia & Qatar leading effort.





## WATER PRIVATIZATION

- ***EXAMPLES – UNITED ARAB EMIRATES***
  - Deregulation of power & water sector fully
  - Establishment of regulation and supervision bureau for water and electricity to license operating companies, establish quality standards and develop the tariff structure.
  - Establishment of federal and state water authorities (FEWA, ADWEA, DEWA, SEWA) replacing Water & Electricity Department (WED).



# WATER PRIVATIZATION

- ***EXAMPLES – UNITED ARAB EMIRATES***

- **Implementation of 7 IWPP Projects:**

1. Taweelah, first SWRO IWPP(ADWEA) – 190,000 m<sup>3</sup>/day
2. Mirfa (ADWEA) – 264,000 m<sup>3</sup>/day
3. Shuweihat S2 (ADWEA) – 264,000 m<sup>3</sup>/day
4. Jebel Ali I Station (DEWA) – 224,000 m<sup>3</sup>/day
5. Umm Al-Nar (ADWEA) – 264,000 m<sup>3</sup>/day
6. Fujairah II (ADWEA) – 264,000 m<sup>3</sup>/day
7. Taweelah A1 (ADWEA) – 224,000 m<sup>3</sup>/day



## WATER PRIVATIZATION

### • *EXAMPLES - SAUDI ARABIA*

- World's largest producer of desalinated water (18% of world's total; 50% of region's)
- Setup of Ministry of Water & Electricity to establish water sector investment guidelines
- Setup of Electricity & Cogeneration Regulatory Authority (ECRA) to facilitate restructuring of water & power sectors
- Setup of Water & Electricity Company (WEC) to buy power and water from IWPPs, supply fuel and monitor power, water quality & energy usage.





# WATER PRIVATIZATION

- ***EXAMPLES - SAUDI ARABIA***

- **SWRO IWPP'S tendered to date:**
  1. Shuaiba IWPP – 880,000 m<sup>3</sup>/day; 2009
  2. Shuaiba IWPP Expansion – 150,000 m<sup>3</sup>/day; 2009
  3. Shuqaiq IWPP – 212,000 m<sup>3</sup>/day; 2010
  4. Jubail-MARAFIQ IWPP – 340,000 m<sup>3</sup>/day; 2010
  5. Ras Al-Khair IWPP – 1,000,056 m<sup>3</sup>/day (retendered)
- **Restructuring and transfer of SWCC's assets to private investors, including research and training centers progressively.**



## WATER CONSERVATION ☺



“Water is a necessity of life  
Conserve your use of it”



## WATER MISUSE ☹️





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**Thank You  
for Your  
Attention  
ANY QUESTIONS?**