

CPET, Continued
Professional
Education
and Training



THE MIDDLE EAST DESALINATION RESEARCH CENTER

Cost Estimating of SWRO Desalination Plants

*Day 2: Total Capital Costs and
O&M Expenditures*

June 26, 2013

13:00-14:30



Water Globe

2.3 Fixed and Total O&M Costs

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Fixed and Total O&M Costs - Outline

- Labor
- Maintenance
- Environmental and Performance Monitoring
- Indirect O&M Costs
- Total O&M Costs

Total O&M Cost Breakdown

Annual O&M Cost Breakdown

Cost Item	Percentage of Total O&M Cost (%)	
	Low-Complexity Project	High-Complexity Project
Variable O&M Costs		
5. Power	45.0 – 61.0	35.0 – 58.0
6. Chemicals	3.0 – 6.5	5.5 – 9.0
7. Replacement of Membranes and Cartridge Filters	5.0 – 9.0	6.5 – 11.0
8. Waste Stream Disposal	2.5 – 5.5	3.5 – 7.0
Subtotal - Variable O&M Costs	55.5 – 82.0	50.5 – 85.0
Fixed O&M Costs		
5. Labor	5.0 – 9.5	4.0 – 11.0
6. Maintenance	6.5 – 12.5	3.0 – 13.0
7. Environmental and Performance Monitoring	0.5 – 4.0	1.0 – 5.0
8. Indirect O&M Costs	7.5 – 18.5	7.0 – 20.5
Subtotal - Fixed O&M Costs	19.5 – 44.5	15.0 – 49.5
Total O&M Costs	100 %	100 %

Fixed O&M Costs - Labor

Annual O&M Cost Breakdown		
Cost Item	Percentage of Total O&M Cost (%)	
	Low-Complexity Project	High-Complexity Project
Variable O&M Costs		
5. Power	45.0 – 61.0	35.0 – 58.0
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Total O&M Costs	100 %	100 %

Fixed O&M Costs Labor

- ▶ Labor Costs - US\$0.015 to 0.035/m³
- ▶ Include:
 - All staff related costs – salaries, benefits, and subcontracted labor
- ▶ Costs and Staff Number Dependent on:
 - Size of Plant
 - Level of Plant Automation and Use of Subcontractors for Maintenance of Key Equipment

Total Number of Plant O&M Staff

Seawater Desalination Plant Staffing Requirements

Plant Capacity (m ³ /day)	Plant Automation, Complexity and Labor Skill Level	
	High	Low
1,000	2 - 3	4 - 6
5,000	4 - 6	8 - 10
10,000	7 - 10	12 - 14
20,000	9 - 12	16 - 18
40,000	12 - 16	18 - 20
100,000	14 - 18	20 - 24
200,000	18 - 28	30 - 40
300,000	35 - 50	60 - 80

Fixed O&M Costs - Maintenance

Annual O&M Cost Breakdown		
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Total O&M Costs	100 %	100 %

Fixed O&M Costs Maintenance

- ▶ Maintenance Costs - US\$0.025 to 0.065/m³
 - 2 % of the construction cost of most structures;
 - 4 % of equipment costs
- ▶ Include:
 - Routine (Preventive) Maintenance;
 - Emergency (Reactive) Maintenance.
 - Spare Parts and Equipment
 - Rebuilding High Pressure Pump Internals Every 5 Years;
 - Rebuilding ERDs every 10 Years

Fixed O&M Costs - Environmental and Performance Monitoring

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Total O&M Costs	100 %	100 %

Fixed O&M Costs Environmental and Performance Monitoring

- Environmental Monitoring Costs –
US\$0.005 to 0.020/m³
- Plant Performance Monitoring Costs –
US\$0.005 to 0.015/m³
- Environmental Monitoring Costs Include:
 - Plant Discharge Sampling;
 - Offshore Data Collection.
- Plant Performance Monitoring Costs Include:
 - Source and Product Water Sampling;
 - Process Data Collection and Analysis

Fixed O&M Costs - Indirect Expenditures

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Total O&M Costs	100 %	100 %

Fixed O&M Costs Indirect Expenditures

- ▶ Indirect O&M Costs – US\$0.004 to 0.10/m³
- ▶ Include:
 - Administrative Costs;
 - Operations Insurance;
 - O&M Reserve Funds Required by Investor (Project Risks)
 - Contingency;
 - Staff Training and Professional Development;
 - Operator Fees (if private operator runs the plant).

Total O&M Costs - Sum of Fixed and Variable Costs

Annual O&M Cost Breakdown		
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Total O&M Costs	100 %	100 %

Example of O&M Costs for 40,000 m³/day Plant w/ Low-Cost Intake & Outfall

Cost Item	Cost (US\$/yr)	% of Total
Energy @ US\$0.055/kWh and 4.03 kWh/m ³	3.24 MM/yr	55.5 %
Chemicals	0.35 MM/yr	6.0 %
Replacement of RO Membranes & Cartridge Filters	0.62 MM/yr	10.6 %
Waste Stream Disposal	0.26 MM/yr	4.4 %
<i>Total Variable Costs</i>	<i>4.47 MM/yr</i>	<i>76.5 %</i>
Labor	0.33 MM/yr	5.7%
Maintenance	0.38 MM/yr	6.5 %
Environmental & Performance Monitoring	0.09 MM/yr	1.5 %
Other O&M Costs	0.57 MM/yr	9.8 %
<i>Total Fixed Costs</i>	<i>1.37 MM/yr</i>	<i>23.5%</i>
TOTAL ANNUAL O&M COSTS	\$5.84 MM/yr	100 %

Annual O&M Costs = US\$5.84 MM/(40,000 m³/dayx365 days) =



Question

Coffee Break

Coffee Owls

Half-Caf

Decaf

Espresso

Regular

