



# COST ESTIMATING OF SEAWATER REVERSE OSMOSIS DESALINATION PROJECTS

This training course presents methodology and excel-spreadsheet based models for preparation of cost estimates for medium and large-size seawater reverse osmosis (SWRO) desalination projects. The cost modeling encompasses plant construction expenditures; annual operation and maintenance (O&M) costs; and overall fresh water production costs. The course provides practical understanding of key technical and economic factors such as source water quality, desired product water quality, plant size, funding mechanism, method of project delivery, energy, labor, chemicals, materials and consumables which determine the site specific capital and O&M costs for a given desalination project. The three-day training course includes one-day of interactive hands-on session in which participants will have the opportunity to learn how to use an excel spreadsheet-based cost estimating model and will have the opportunity to apply this model for a specific SWRO desalination project case study.

## 3-DAY COURSE

Leading Lecturer:

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## PROGRAM OUTLINE

### **Day 1: Desalination Plant Operation and Performance Monitoring**

#### **09:00 – 10:30 - 1.1 Project Cost Estimating – Overview**

- Project Cost Definitions
- General Methodology for Preparation of Project Cost Estimates
- Type and Accuracy of Project Cost Estimates
- Cost Models

### **10:30 – 10:45 Coffee Break**

### **10:45 – 12:00 Project Cost Factors**

- Introduction
- Factors Impacting Project Costs within the Control of Project Owner
  - ✓ Project Size
  - ✓ Capacity Availability Factor
  - ✓ Source Water Quality
  - ✓ Target Product Water Quality
  - ✓ Concentrate Disposal Method
  - ✓ Power Supply and Unit Power Costs
  - ✓ Project Risk Profile
  - ✓ Other Project Cost Factors
- Project Cost Factors Outside of the Control of Project Owner

### **12:00 – 13:00 Lunch Break**

### **13:00 – 14:30 Estimating Direct Capital (Construction) Costs**

- Plant-site Related Construction Costs
- Intake Costs
- Pretreatment Facility Construction Costs
- SWRO System Equipment Costs
- Post-treatment Costs
- Concentrate Disposal Costs
- Waste and Solids Handling Costs
- Costs of Electrical and Instrumentation Systems
- Costs of Auxiliary and Service Equipment and Utilities
- Building Costs
- Startup, Commissioning and Acceptance Testing Costs

### **14:30 – 14:45 Coffee Break**

### **14:45 – 16:30 – 1.4 Estimating Indirect and Total Capital Costs**

- Costs for Project Engineering Services
  - ✓ Preliminary Engineering
  - ✓ Pilot Testing
  - ✓ Detailed Design

- ✓ Construction Management and Oversight
- Project Development Costs
  - ✓ Project Administration, Contracting and Management
  - ✓ Environmental Permitting
  - ✓ Legal Services
- Project Financing Costs
  - ✓ Government Financing
  - ✓ Conventional (Bond or Construction Loan) Financing
  - ✓ Private Project Financing
  - ✓ Interest During Construction
  - ✓ Debt Service Reserve
  - ✓ Other Financing Costs
- Contingency

### **16:30 – 17:00 Questions and Discussions**

## **Day 2: Operation and Maintenance Costs**

### **09:00 – 10:30 Variable O&M Costs**

- Power
- Chemicals
- Replacement of Membranes and Cartridge Filters
- Waste Stream Disposal

### **10:30 – 10:45 Coffee Break**

### **10:45 – 12:00 RO Fixed O&M Costs**

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

### **12:00 – 13:00 Lunch Break**

### **13:00 – 14:30 Cost of Water Production**

- Fixed Cost Components
  - ✓ Capital Cost Recovery
  - ✓ Other Fixed Costs
- Variable Cost Components
- Total Cost of Water Production

### **14:30 – 14:45 Coffee Break**

### **14:45 – 15:00 - 2.4 Desalination Cost Trends**

- Overview Recent SWRO Desalination Projects and Their Cost Breakdown
- High-End Cost Projects – Key Factors Contributing to Their High Costs
- Low-End Cost Projects – Key Factors Resulting in Their Low Costs
- Impact of Project Delivery Method of Costs
  - ✓ Design-Bid-Build (DBB) Projects
  - ✓ Design-Build-Operate (DBO) Projects
  - ✓ Build-Own-Operate-Transfer (BOOT) Projects

### **15:00 – 16:30 Example of SWRO Project Cost Estimate**

- Project Description
- Breakdown of Project Capital Costs
- Annual O&M Costs
- Cost of Water Estimate

### **16:30 – 17:00 Questions & Discussions**

## **Day 3: Hands-on Training on Desalination Project Cost Modeling**

### **09:00 – 10:15 Introduction to Excel Cost-Estimating Spreadsheet**

- Master Data Input Form – Parameters and Use
- Advanced Input Form
- Capital Cost Output
- O&M Cost Output

### **10:15 – 10:30 Coffee Break**



### **10:30 – 12:00 Project Case Study Demonstrating the Use of the Cost Model**

- Overview of Project Input Data
- Definition of Baseline and Worst-Case Scenarios Used for Cost Estimating
- Review of Cost Model Outputs for Baseline and Worst-case Scenarios
- Demonstration of Cost Impacts of Various Project Factors
- Division of Project Participants into Five 7-People Work Teams and Assignment of Individual Project Case Study to Each Team

### **12:00 – 13:00 Lunch Break**

### **13:00 – 14:00 Development of Project Cost Estimates by the Work Teams**

- Work of Seven Individual Teams on their Project Cost Assignments

### **14:00 – 14:15 Coffee Break**

### **14:15 – 15:30 Presentations of Cost Estimates Developed by the Work Teams**

- Each of Five Work Teams Gives 15-minute Presentation of their Cost Estimate

### **15:30 – 16:00 Discussions of Cost Model and Case Study Cost Estimates**

### **16:00 – 17:00 Multiple Choice Test and Adjourn**

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