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## **BEST PRACTICES FOR SYSTEM DESIGN AND DEVELOPMENT OF TURNKEY DESALINATION PROJECTS**



**May 31– June 1, 2017  
Rome, Italy**

**Lecturers Mark Wilf, PhD, Nikolay Voutchkov, PE**

### **Day 1 – Effective approach to desalination system design**

**09:00–10:00 Desalination plants configuration and feed water sources**

- Configuration of brackish RO water desalination systems
- Configuration of seawater RO desalination systems
- Configuration of advanced wastewater reclamation systems
- Feed water supply sources and water quality
  - Brackish wells
  - Seawater intakes
  - Tertiary effluent
- Disposal of RO concentrate

**10:00–10:45 Feed water pretreatment processes and high pressure pumping unit**

- Pretreatment in RO brackish plants processing well water
- Pretreatment in seawater RO plants
  - Pretreatment based on media filtration
  - Pretreatment based on membrane filtration
- Pretreatment in wastewater reclamation plants
- Management of pretreatment discharge residuals
- High pressure pumping unit
  - Brackish water RO plants
  - Wastewater RO plants
  - Seawater RO plants
- Energy recovery devices
- Optimization of power usage

**10:45–11:00 Coffee break**

**11:00–12:00 RO membranes and membrane elements**

- Configuration of composite RO membranes and membrane elements
- Nominal and field performance of membrane elements
- Effect of process parameters on membrane performance.
- Management of membrane elements inventory in RO desalination system

- 12:00–13:00     Design of RO membrane unit**  
Selection of membrane elements according to application  
Optimization of membrane array  
    Recovery rate considerations  
    Train size consideration  
    Consideration of product water demand  
Design of RO membrane unit utilizing computer projection programs  
    Brackish water RO plants  
    Wastewater RO plants  
    Seawater RO plants
- 13:00–14:00     Lunch break**
- 14:00–15:00     Chemistry and configuration of permeate water post treatment process**  
Chemistry of the post treatment process  
Process and configuration of post treatment process  
    Brackish water RO plants  
    Wastewater RO plants  
    Seawater RO plants
- 15:00–15:15     Coffee break**
- 15:15–16:00     Examples of configuration of commercial desalination plants**  
Brackish RO–NF water plants  
    Boca Raton, Florida  
    Arlington Desalter, California  
Wastewater reclamation plants  
    GWR, Orange County, California  
    Bedok Plant, Singapore  
Seawater RO plants  
    Carlsbad, California  
    Tuas, Singapore
- 16:00–17:00     Consideration of plant design optimization**  
Project requirements included in the Project Scope Book  
Feed water supply and site conditions  
Power supply structure  
Pilot unit operation
- 17:00–17:30     Questions and Discussions**

## **Day 2 – Roadmap to Successful Desalination Project Development**

- 09:00–10:00     Overview of the project development process**  
Type of project delivery alternatives and role of developer  
Initial project prospecting and development – defining project scope  
Developing of estimates for costs of water production and water sales  
Obtaining of project entitlements  
    Use of plant site  
    Environmental permitting  
    Water purchase agreement  
    Power purchase agreement  
    Rights of way for access to intake and discharge  
    Rights of way for product water delivery

Procurement of turnkey construction and operation contractors  
Project financing  
Project design, construction, commissioning and acceptance testing  
Desalination plant asset management during plant operation phase

**10:00–10:45    Key project risks and their effective management**

Permitting (licensing) risks  
Entitlement risks  
Risks associated with power supply and use of alternative power sources  
Construction risks  
Source water quality related risks  
Technology risks  
Regulatory risks  
Operational risks  
Desalinated water demand risks  
Financial risks

**10:45–11:00    Coffee break**

**11:00–12:00    Project Delivery alternatives - role of project developer/owner**

Design-bid-build (DBB)  
Design-build-operate (DBO)  
Build-own-operate (BOO) and build-own-operate-transfer (BOOT)  
Concession

**12:00–13:00    Initial project scoping and development**

Defining product water quantity and quality  
Selecting plant site – location, configuration and size  
Identifying the most suitable type of intake and outfall  
Selecting key desalination process treatment processes  
Finding cost competitive power supply sources

**13:00–14:00    Lunch break**

**14:00–15:00    Determining water production costs and project funding**

Engineering, procurement and construction costs  
Operation and maintenance costs  
Costs of water production  
Water sales tariff  
Project funding alternatives and their contractual structure

**15:00– 15:15    Coffee break**

**15:15–16:00    Project permitting – key issues and considerations**

Intake permitting issues  
Concentrate discharge – challenges and solutions  
Product water quality related permitting considerations  
Addressing zero carbon-footprint requirements for desalination plants  
Selecting key desalination process treatment processes

**16:00–17:00    Project development case studies**

200,000 m<sup>3</sup>/d Carlsbad SWRO desalination project, USA  
20,000 m<sup>3</sup>/d Majis SWRO desalination project, Oman

**17:00–17:30    Questions and discussions**

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☐ Before March 1, 2017 **€3,200**

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