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| **Sector** | **Urban Development** |
| **Sub Sector** | **Water Infrastructure** |
| **Project No.** | **UD - 09** |
| **Project/Product** | **Water Desalination Project** |

## Project Description

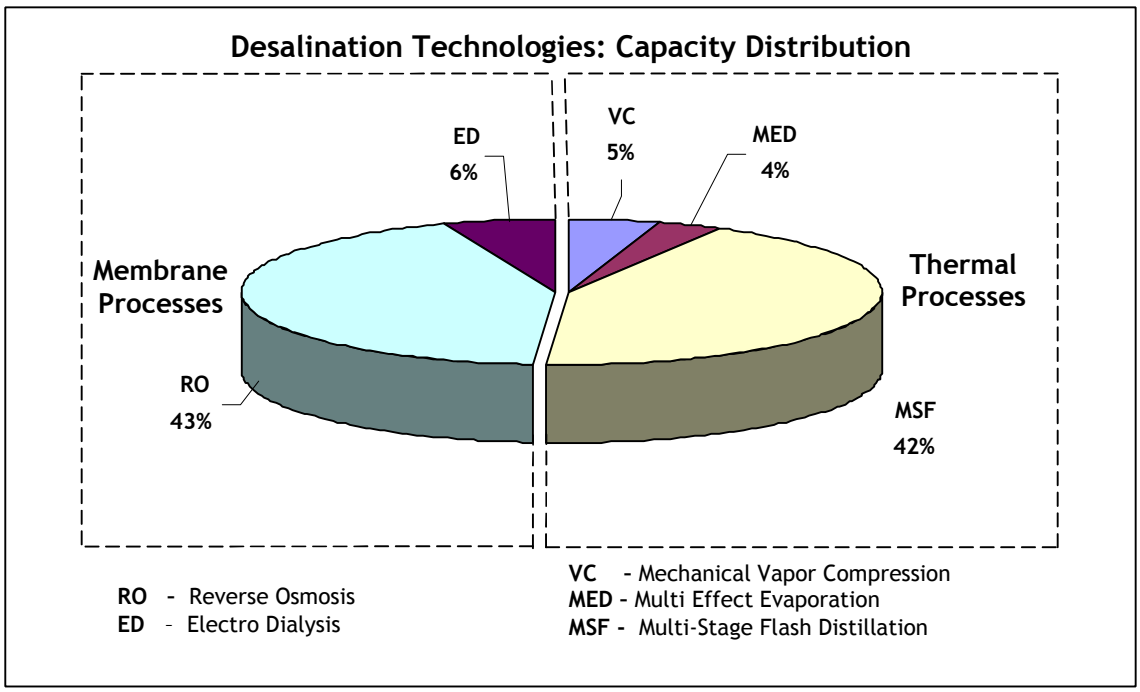
The coastal belt of Saurashtra - Kutch region in Gujarat has always been facing acute shortage of water. The industrial development also faces a setback due to non-availability of water. The situation has improved to a great extent in recent years due to extension of Sardar Sarovar Canal Network in this region. But, the fact that the State Government had to run "Water special trains" from Gandhinagar to Rajkot / Saurashtra region before few years, reflects the severity of water shortage in the region.

One of the solutions to perennial water shortage in Saurashtra and Kutch regions is setting up of large Desalination Plants in the coastal areas. Desalination of seawater is a feasible option considering:

- Growth of desalination projects globally and especially in Gulf and Middle East, where desalination is now a technology of choice.
- Dramatic decline in cost that has led to it being a viable and economic solution to ensure future water supplies in some of the countries.
- Success demonstrated by Reliance Petroleum at Jamnagar and Sanghi Cement in Kutch.

## Desalination: Global Scenario

Currently over 12,500 industrial scale desalination units are operating worldwide. The current installed capacity of desalination plants has been estimated at about 10,000 MGD globally. The share of different technologies has been indicated in the figure below:




Different technologies have been in operation depending on effectiveness and economics in local conditions, i.e. Membrane Processes (Reverse Osmosis and Electro-Dialysis) and Thermal Processes (Multistage Flash Evaporation, Vapour Compression and Multi effect evaporation). Both Membrane and Thermal processes appear to be equally popular. However, the extent of popularity differs among various technology variants under these basic processes, i.e. Among Thermal processes, Multi-stage flash evaporation technology is most popular, while among Membrane processes, Reverse Osmosis is the most preferred technology.

Desalination costs have been continuously decreasing over the years as a result of advances in system design and operating experience, and the associated reductions in specific unit size and specific power consumption.

Middle East countries are the biggest users of desalination technology, with over 50% of the world's capacity. Gulf States such as Saudi Arabia, the UAE and Kuwait use dual-purpose power and desalination plants on a major scale. With the continued deterioration of existing groundwater resources, the technology is finding new outlets in parts of the region where it had never previously been considered as a viable long term resource. Desalination requirements in the Gulf - Middle East region are slated for substantial growth.

The successful introduction of desalination technology for meeting combined needs of power and water is further leading the market development. Several such projects are under implementation, e.g. IWPP at Ras Laffan-Qatar having generating capacity of 750MW and a water output of 40MGD, IWPP at Shuweihat in Abu Dhabi (1500MW and 100MGD) and Barka in Oman (400-440MW and 20MGD).

The types of desalination technology used in integrated power and water schemes in the region have been multistage flash (MSF), multi effect distillation (MED) and reverse osmosis (RO).

MSF was developed in the Gulf States as early as the 1970s and has been used successfully in the Arabian Peninsula in large scale applications. The capital costs of MSF vary from $4.00 to $12.00/gpd equivalent to $1050 to $3150/m3 per day of installed capacity.

MED is older than MSF and is more energy efficient. However, the technique has suffered some operational problems and its maximum unit capacity is limited compared to MSF.

The future of desalination technology will depend largely on reducing energy costs by optimising power and water generation. It will also rely on further improvements in the unit size of RO and distillation processes.

In the short term, new solutions are required to address the trend of water demand growing at a greater rate than electricity and the dramatic seasonal variation of power. Some analysts claim that the seasonal surplus of unused idle power could be used by electrically driven technologies such as RO and vapour compression distillation in combination with aquifer storage and recovery.

## Why Gujarat?

- The proposed project in Kutch has excellent scope considering the industries, set up in Kutch, in the wake of a series of tax concessions granted by both the Union government and the Gujarat government, are meeting their water requirements through underground water sources.
- The water available from this desalination plant can flow through the present Narmada pipeline to industries in Kutch, i.e. the facility for transmission of water is already in place.
- Abundant availability of cheap lignite (which can be used as a fuel in the associated captive power plant) would ensure significant reduction in operating costs and unit cost of generation.
- Interest already evinced by the Government and local industries to participate in the proposed desalination project.
- Conducive business environment -Progressive and Investment friendly State Government, Business oriented mindset & culture.
- Gujarat has some of the best technical and management institutes in India. Further, the average skilled manpower cost is lower in Gujarat as compared to other states in India.
- Minimum loss of man days due to labour unrest in the State.

## Technology / Process

The most widely used desalination processes are membrane separation via reverse osmosis (RO), and three types of thermal separation — multistage flash desalination (MSF), multiple-effect evaporation, with thermal vapor compression (MEE-TVC) and without (MEE), and mechanical vapor compression (MVC). The MSF and RO processes dominate the market for both brackish water and seawater desalination, with a total share of more than 90%.

All three types of thermal desalination systems are equipped with condenser tube bundles. In MSF, these are used to preheat the brine recycle stream. The tube bundles in MEE and MVC function as condensers/evaporators, where the heating steam condenses inside the tubes and vapor is formed outside the tubes. The MEE and MVC systems are divided into evaporating effects, while MSF systems are divided into flashing stages.

The prominent suppliers of desalination technologies are:

- Vivendi, France
- IDE Technologies, Israel
- Degrémont, France

## Suggested Plant Capacity and Indicative Project Cost

The suggested plant capacities for the proposed Desalination Plants are 120 MLD each.

The Investment for the project has been estimated at INR 3,780 million (US $ 84 million) for a plant based on RO Process and INR 5,940 million (US $ 132 million) based on MSF Process. The investment includes cost of associated Power / Cogen Plants.

## Suggested Location

The proposed project can be ideally located in the vicinity of industrial clusters in Kutch (i.e. Kandla, Gandhidham or Mundra).

## Project Time Line

The project can be implemented within 18-20 months.

## Financial Indicators

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| Debt-Equity Ratio | : | 2 : 1 (Preferably through SPV Route) |
| Expected IRR | : | 30-35% (RO Process) |
| | | 20-25 % (MSF Process) |

## Clearances required

- NOC from Gujarat Pollution Control Board
- Industries Entrepreneur's Memorandum to Secretariat of Industries approval.

## Agencies to be contacted

Industrial Extension Bureau

Mott MacDonald India

Gujarat Urban Development Company Limited