

Barge Mounted Low Temperature Thermal Desalination Plant

Kathioli S., Purnima Jalihal, Phanikumar V S Sistla.

National Institute of Ocean Technology
Chennai, India

ABSTRACT

The paper presents the design, installation and performance of the 1000 m³/day experimental barge mounted desalination plant. The plant was moored in 600 m water depth, to draw 10-12°C cold water from about 500 m water depth. A single point mooring system, the first of its kind in Asia for depths in the range of 600~1000 m, was used to position the barge at the location. High density polyethylene pipe (HDPE) was welded to 500 m length and towed to the site in floating condition. One end of the pipe was sunk with weights after attaching the other end to the suction end of a pump at the bottom of the floating vessel.

The interface between the floating vessel and the HDPE pipe formed the most critical component of the exercise, needing detailed analyses to minimize the effects of differential dynamic response of the barge and the HDPE pipe to ocean waves. The paper discusses the pipe and mooring configuration, the thermal parameters of plant, the test results and also the difficulties encountered in the pipe deployment.

KEY WORDS: low temperature thermal desalination; risers; deep water mooring.

INTRODUCTION

Thermal gradient between different layers of the ocean water column provides huge reservoirs of warm and cold water that can effectively be utilized for power generation, desalination and air-conditioning. The deep ocean cold water is rich in nutrients and is highly beneficial for aquaculture. Many attempts were made in the past to produce energy and fresh water using ocean temperature difference. The part of this technology that deals with desalination is known as 'Thermocline Driven Desalination' or 'Low Temperature Thermal Desalination' (LTTD). The available thermal gradient between warmer surface water and colder deep seawater is utilized by flash evaporating the warm water at low temperatures and condensing the resultant vapour with cold water.

The acute drinking water shortage experienced by some of the countries around the world makes the concept of desalinated water more relevant for the present day policy makers. A comparative study

of the available technologies, provided in this paper, proves that the concept of LTTD provides a clean and environmentally friendly way to obtain fresh drinking water at a competitive price.

National Institute of Ocean Technology (NIOT), India, has embarked on a program to implement a cost effective desalination technology that utilizes ocean thermal gradient to produce desalinated water. NIOT has successfully demonstrated the process with two desalination plants, a 100 m³/day land based desalination plant at Kavaratti, India, meant for islands and a 1000 m³/day barge mounted desalination plant 40 km off Chennai coast meant for mainland usage. The plants were designed on the concept of LTTD. The main challenge in the plant was the supply of cold water from an appropriate ocean depth for which a long pipe was required.

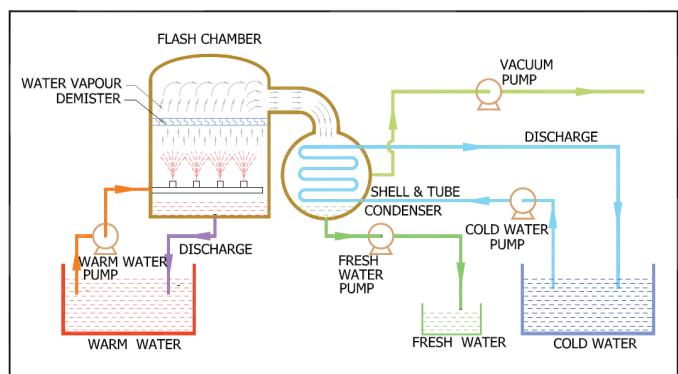


Fig. 1 A Schematic of LTTD Process

The 100 m³/day plant at Kavaratti of the Lakshadweep group of Islands in India has been working since its commissioning in 2005, meeting the drinking water needs of the island. The configuration involved a Flash Chamber that evaporated the surface sea water at low pressures to obtain the fresh vapour at 21-23°C and a condenser that liquefied the resultant vapour using the deep sea water at 10-12°C. A schematic of the process is shown in Fig. 1. The entire plant operated with the help of just three sets of the pumps, namely one each for warm water, cold water and vacuum. The cold water for this land based plant needed a