



## WAIV – Wind aided intensified evaporation for brine volume reduction and generating mineral byproducts

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### ABSTRACT

In this study bench pilot WAIV units ( $\sim 1 \text{ m}^2$  evaporation area loaded on  $0.17 \text{ m}^2$  footprint) were operated on two different desalination brines (RO and ED) as well as on a mineral brine concentrate under arid conditions of the Negev Highlands. The evaporation rate with the WAIV unit on these feeds often gave evaporation rates per footprint that were 10-fold or greater than the pan evaporation rate obtained from the local meteorological station at Sde Boker. Desalination brines were concentrated up to 23% TDS when operating on ED concentrate. The evaporation from the WAIV unit demonstrated enrichment in the magnesium ion compared to the calcium and the sodium ion, including over a two-fold enrichment of magnesium relative to calcium as would be expected by the equilibrium solubilities of the different minerals. Despite precipitation of minerals, there is not a large buildup of deposit on the flexible evaporation surface, and this helps establish the feasibility for recovering minerals from the desalination brine by using WAIV unit. For the ED-RO hybrid desalination process which provided one of the feeds to the WAIV unit, WAIV capital costs will only be about 5.5% of the annualized desalination costs (CAPEX and OPEX).

**Keywords:** Inland desalination; Brine disposal; Concentrate management; Evaporation ponds

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### 1. Introduction

The demand for freshwater in many regions of the world has outstripped supply. More than 50% of the countries in the world will likely face water stress or water shortage by 2025, and by 2050, as much as 75% of the world's population could face water scarcity [1].

The population growth and the lack of quality resources lead to the need for water utilities to treat impaired water sources and for desalination to generate new water resources. Desalination is growing rapidly, and the efficiency of the technology has

significantly improved over the last decade especially in seawater desalination. There are still critical actions that need to be made in order to make this technology more cost effective, especially for inland desalination [2]. One of the main challenges is to find a suitable disposal options for the brines produced in inland desalination plants which is both cost effective and environmentally sustainable.

There are several concentrate disposal methods such as: surface water, sewer system discharge, deep well injection, land application, Zero Liquid Discharge (ZLD), and evaporation ponds. Rarely are more than one or two option available at a given plant site [3]. The most straightforward method for brine disposal is

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