

# A comparative life cycle assessment of process water treatment technologies at the Secunda industrial complex, South Africa

**C Ras\* and H von Blottnitz**

*Environmental and Process Systems Engineering Research Group, Department of Chemical Engineering, University of Cape Town, Cape Town, South Africa*

## Abstract

The increasingly poor quality of South Africa's natural water sources requires industries and power stations to treat raw water extensively prior to industrial use in, for example, boilers. Two different raw water desalination technologies, an existing ion exchange plant and a proposed reverse osmosis intervention, are compared by life cycle assessment for the production of 1 Ml of boiler feed water, in the context of the Secunda industrial complex situated in Mpumalanga, South Africa. The proposed reverse osmosis option would perform 22% worse for global warming potential, which relates to the use of coal-derived electricity, but would reduce burdens of the ion exchange option on human toxicity and fresh-water aquatic ecotoxicity due to the use of an aluminium sulphate coagulant. Significantly, the assessment predicts the reverse osmosis option to effect a 78% overall reduction in storage of problematic salts, from 599 kg/Ml to 133 kg/Ml. Notwithstanding the fact that the power generated within the complex and used by the RO process is associated with a high salts burden (mine water is desalinated at the power station), it was found that the reverse osmosis intervention would incur a lower salts footprint than the IX/S technology and would not shift salts burdens.

**Keywords:** industrial water systems, life cycle assessment, desalination, technology comparison, ion exchange, reverse osmosis