Influence of site-specific parameters on environmental impacts of desalination

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ABSTRACT

Many metropolitan areas have a high dependency on Seawater Reverse Osmosis (SWRO) desalination plants for bulk water supply. Location and scale decisions are important for SWRO desalination plants owing to the significant environmental costs associated with long distance water pumping. The aim of this study is to introduce a Geographical Information System (GIS)-based method to assist such site-specific decisions. The method has 3 stages. Stage 1 uses GIS to identify feasible plant locations and water demand areas. Stage 2 develops a range of scenarios that balance plant size and number with water demand. In stage 3, the preferred scenario is selected based on environmental life cycle assessment. The method’s applicability was tested using data for the northern corridor of Perth, Western Australia (WA). Spatial water demand and suitable vacant land for accommodating SWRO plants in the case study are obtained in Stage 1. Based on these spatial data, two water planning options are designed in order to supply desalinated water to the demand area. The first option consists of a large SWRO desalination plant and its connected trunk main which supplies water into the demand centrally (centralized scenario). Second option consists of five medium-sized SWRO desalination plants integrated within the demand area (distributed scenario). The best scenario for environmental performance was found to be the distributed scenario which has 18% less GHG emission compared to centralized scenario. This method is adaptable to other case studies for identifying optimal SWRO plant sizes and locations based on environmental criteria.

Keywords: Distributed water supply; GIS; Life cycle assessment; Perth; Reverse osmosis; Plant size

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