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Article

Assessing Future Water Demand and Associated Energy Input with Plausible Scenarios for Water Service Providers (WSPs) in Sub-Saharan Africa

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Abstract: This study examined the current state of water demand and associated energy input for water supply against a projected increase in water demand in sub-Saharan Africa. Three plausible scenarios, namely, *Current State Extends* (*CSE*), *Current State Improves* (*CSI*) and *Current State Deteriorates* (*CSD*) were developed and applied using nine quantifiable indicators for water demand projections and the associated impact on energy input for water supply for five Water Service Providers (WSPs) in Kenya to demonstrate the feasibility of the approach based on real data in sub-Saharan Africa. Currently, the daily per capita water-use in the service area of four of the five WSPs was below minimum daily requirement of 50 L/p/d. Further, non-revenue water losses were up to three times higher than the regulated benchmark (range 26–63%). Calculations showed a leakage reduction potential of up to 70% and energy savings of up to 12 MWh/a. The projected water demand is expected to increase by at least twelve times the current demand to achieve universal coverage and an average daily per capita consumption of 120 L/p/d for the urban population by 2030. Consequently, the energy input could increase almost twelve-folds with the *CSI* scenario or up to fifty-folds with the *CSE* scenario for WSPs where desalination or additional groundwater abstraction is proposed. The approach used can be applied for other WSPs which are experiencing a similar evolution of their water supply and demand drivers in sub-Saharan Africa. WSPs in the sub-region should explore aggressive strategies to jointly address persistent water losses and associated energy input. This would reduce the current water supply-demand gap and minimize the energy input that will be associated with exploring additional water sources that are typically energy intensive.

Keywords: drinking water supply; energy input; future water demand; water demand-supply gap; water service providers (WSPs)

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1. Introduction

Energy is a major input and cost factor for water supply. It effects the operational costs recovery of water supply and the ability of Water Services Providers (WSPs) to extend and deliver quality water services [1]. The largest energy consuming devices are the pumping systems which take up to 90% of the total energy input for water abstraction, conveyance, treatment, and distribution [2]. Energy requirement for water supply is influenced mainly by the operational efficiency of water supply infrastructure, type of raw water input, climate, topographical features, and water consumption patterns [3].

In recent years, there is an increased focus on water and energy efficiency measures for WSPs due to high and unstable energy prices, an ever-increasing water demand and the need to explore alternative water sources that are relatively less energy intensive. Consequently, undertaking energy efficiency measures provides opportunities for WSPs