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MANAGING THE MISMATCH OF WATER SUPPLY AND DEMAND IN SELANGOR USING BAYESIAN MODELLING CONSIDERING CLIMATE CHANGE EFFECT AND HYDROECONOMIC PROJECTION

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ABSTRACT

Water sustainability is a major concern in the state of Selangor. With the rapid increase in the population and its economic sectors, water supply availability has become crucial in meeting the state's water consumer demands. To manage the mismatch between the water supply and demand in the state of Selangor, the study focused on three main objectives; to evaluate the raw water supply in the catchments focusing on the climatic changes and hydrometeorological aspects, to evaluate the treated water demand focusing on the economic aspects through hydroeconomic modelling and to apply Bayesian approach in modelling the imbalances by introducing water interventions. Two main catchments were chosen as study site; Selangor and Langat as it represents the major water supply in the state of Selangor. While, three main economic sectors; agriculture, city and industry were used in the study to capture the state's main water consumer. Two scenarios were then simulated; Reference and High Population. Reference simulates business as usual while High Population simulates a population with a growth of 7%. Then, three main models were used in balancing the mismatch; climate change model, hydroeconomic model and Bayesian model. Climate change model simulates the climatic effect onto both catchments' precipitation. With climate input, hydroeconomic model was used to model the demand side management via interventions for the economic sectors in balancing the mismatch. Bayesian model was then used to predict the probability of net improvement upon using the interventions. Results indicates that agriculture water demand in both Selangor and Langat catchments were well sustained through its water supply. However, deficit in water supply was detected for City and Industry sector for both Selangor and Langat catchments under Reference and High Population scenarios. Hydroeconomic model through demand side management was conducted with the supply and demand gap through the implementation of groundwater and water savings reduced by 62.24%, 57.37%, 98.13% 101.09% respectively in Selangor City Reference, Langat City Reference, Selangor Industry Reference and Langat Industry Reference. High population gap reduction was 97.70%, 24.43%, 173.34% and 3.75% in Selangor City-HP, Langat City-HP, Selangor Industry-HP and Langat Industry-HP. Then, to sustain the supply in meeting the demand, existing tariff need to be increase by 50% (Tariff C), large improvement needs to be conducted on the operation and maintenance (High operation and maintenance), water saving being fully implemented (High water saving) and water consumers are high in their awareness (High behaviour). Upon such actions, net improvement obtained were 99.3%. 99.2%, 100.0% and 99.9% respectively while the gap between supply and demand were reduced by 37.06%, 41.83%, 2.30% and 75.47% respectively. In conclusion, the water supply and demand mismatch in the state of Selangor can be balanced through increment in water tariff, improvement in the operation and maintenance, implementation of water savings and the change in the water consumers behaviour.

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CHAPTER ONE
INTRODUCTION

1.1 Introduction

The rapid growth of urban development and its population in the state of Selangor makes the state's water supply in meeting with the demand a challenge in the state's water management. The challenges can be categorized into six categories namely; climate change, raw water, water demand, water losses, water tariff and economy that affects the water demand. With the climate change that influenced the dry spell in the state of Selangor, the level of rivers and dams has shrunk due to low amount of rainfall in Selangor (SPAN, 2016). Seven dams that store raw water for the treated water to Selangor has declined to low levels. For example, in the year 2014, Sungai Selangor Dam and Sungai Tinggi Dam being the largest dams in the state of Selangor supplies 61% of water demand to the state of Selangor recorded the lowest percentage of their deposits at 36.39% and 60.97% respectively. Similarly, other dams, namely, Sungai Langat Dam 48.25%, Klang Gates Dam 50.04%, Sungai Semenyih Dam 70.80%, Sungai Batu Dam 77.06% and Tasik Subang Dam 86.77%. Compared to the same period in previous years, all the dams have 100% of their capacity (Figure 1.1).

Due to the low level of the dam, the Selangor state Government, as the party responsible for the control of water resources in Selangor, has decided to reduce water release from Sungai Selangor and Klang Gates Dam. When water releases are reduced, the production of water treatment plants would be affected. Therefore, water rationing must be implemented to ensure that consumers receive water supply in a fair and equitable manner. These water rationings would then implicate not only the Selangor, Kuala Lumpur and Putrajaya state economy but also the livelihood of the people, as most of the industries and development are dependant of the water supply. Hence, the need to balance the raw water supply in meeting the demands is crucial for sustainable water management.