

**THE EFFECT OF CENTRIFUGAL PUMP
PERFORMANCE DUE TO WATER LEVEL
VARIATION OF THE SOURCE**



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Degree of Master of Engineering

Department of Mechanical Engineering

University of Moratuwa

Sri Lanka

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Thesis submitted in partial fulfillment of the requirements for the degree Master of
Engineering

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DECLARATION OF THE CANDIDATE AND SUPERVISOR

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ABSTRACT

At present, there is very few published literature for energy cost of water supply. National Water Supply and Drainage Board(NWS&SDB) is the prime organization responsible for providing drinking water to public in the country. Therefore the NWS&DB has the vested interest to optimize the energy of operation and maintenance for the water supply schemes in order to give more benefits to the public. Hence it was decided to carry out this research work and to utilize the outcome of the research for the NWS&DB. The effect of water level variation to energy wastage in the water supply intake on Kelani River for Ambatale water supply scheme was selected as this is the most common type of intake of water supply schemes in NWS&DB.

The main focus of this research is to identify and evaluate the energy conservation potential for the water supply scheme.

The research was based on the available data of past records of water supply intake at Ambatale. Such as annual water level variations of the Kelani River at the intake, annual water production, annual electricity consumption, actual pumps performances and system performance data. Data was analyzed to obtain power consumption and intake water level variation, operation condition of pumps and the system was modeled using Water CAD computer model to obtain actual status of the operational condition of pumps and the system. Analyses were carried out for scenarios during drought where highest water level fluctuation is occurred and the normal situation and the flooding situation.

Analyses showed that flow variations in drought were 6,600 m³/day and 5,016m³/day for old and new intakes respectively for single pump operation, resulting total energy loss of 286,413.9 kWh and 1,066.8 kWh per month for old and new intakes respectively and raw water pumping energy variation is about 34%. The highest water level variation the intake was 2.2m. The specific energy consumption for the treatment plant was found to vary between 0.307 kWh/m³ and to 0.479 kWh/m³. Therefore any effort on energy conservation should concentrate more on reducing energy consumption of raw water and distribution pumping.

The research identified raw water pumping energy consumption varies according to the water level of the intake. It is recommended to maintain constant water level in the intake. Otherwise an additional pump to be used with variable speed drive in drought season for pumping water to the treatment plant with separate pipe line.

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LIST OF ABBREVIATIONS

NRW	Non revenue water
NWS&DB	National Water Supply & Drainage Board
CEB	Ceylon Electricity Board
PPs	Independent Power Producers
CAD	Computer Aid Design
SEC	Specific Energy Consumption
H/L	High Lift
L/L	Low Lift
O & M	Operation & Maintenance
RSC	Regional Services Center
GCS	Grater Colombo Sewerage
SEA	Sustainable Energy Authority
WSS	Water Supply Scheme
VFD	Variable Frequency Drive
VSD	Variable Speed Drive
WWUs	Water and wastewater utilities
EE	Energy efficiency
SLSEA	Lanka Sustainable Energy Authority
NPSHR	Net positive suction head required
BEP	Best Efficiency Point
T/P	Treatment Plant



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