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DEVELOPMENT OF SOLAR POWERED PUMPING FOR THE INTEGRATION OF RAINWATER HARVESTED IN MULTISTORY HOUSES

THESIS SUBMITTED TO
THE DEPARTMENT OF MECHANICAL ENGINEERING IN
FULFILMENT OF THE REQUIREMENT FOR THE DEGREE OF
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Declaration

I, Sisuru Sendanayake, hereby declare that the work contained in this thesis has not been previously submitted for a degree or diploma at any other higher education institution. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made.

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I will fail in my duty if I do not mention my wife Chintha, for her ever present support and my daughter Sukhi who has dutifully assisted me in most of the computer work.

Abstract

Rain water Harvesting (RWH) is an ancient civil practice for more than 4000 years, drawing attention among scientists in recent decades in the light of potable water shortages and water based natural disasters such as draughts and flash floods. It is observed that the domestic service water (SW) usage patterns are uniform for a given scenario, where over 30% of drinking quality water being consumed for non potable uses such as WC flushing, for which harvested rain water (RW) could be used. Roof Top Rain Water Harvesting Systems (RTRWHS) suitable for domestic situations are not being widely used due to non-optimizing of the system's highest cost component, the storage facility or the tank. Extensive research has produced a set of generic curves for Water Saving Efficiency (WSE) of a RTRWHS, enabling the selection of an optimum tank size for a given demand. Validation of this for Sri Lanka could provide a valuable design tool. This was undertaken using a prototype where the daily rainfall data was used with selected usages to create a substantial number of data points, which satisfy the generic curves. These data has indicated that the generic curves can be used in Sri Lanka with generally used roof types such as cement fibre and calicut tiles.

In multi-story situations energy is needed for pumping collected rain water to end user points. A strategy should be developed to provide an alternative energy solution to mitigate the strain of extra energy consumption to the national power grid and the resultant Green House Gas (GHG) emissions for RWH to be a true component of sustainable development.

Sri Lanka being a tropical country, solar power option is pursued as the most desirable alternative energy source. Since solar power also has high capital cost, minimization of energy used while relying on gravity systems also have been actively pursued. Identifying the suitability of positive displacement pumps over centrifugal pumps when connected to photo voltaic power source, a viable and cost effective solar pumping system is proposed to be used as an integrated draw-off device for a potential RWH system to be used in domestic situations.

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