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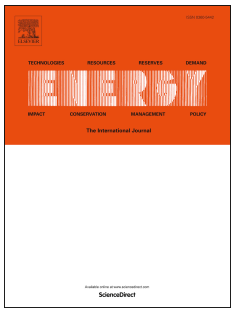

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Minimizing the air demand of micro-hydro impulse turbines in counter pressure operation

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Abstract

Following new and innovative concepts of energy recovery which use micro-hydro impulse turbines in drinking water systems, more sophisticated turbine designs become essential to improve energy recovery efficiency. In the case of implementing a hydraulic impulse turbine with tailwater depression in such systems, one major challenge to optimising overall efficiency is the reduction of the turbine's air demand. Firstly, a lower air demand would reduce the required dimensions of the ventilation system and therefore increase energy efficiency. Secondly, a minimised air demand would considerably reduce the negative effects downstream of the turbine casing, such as a reduced transport capacity and corrosion. To achieve a minimised air demand, detailed experimental investigations are conducted, during which different casing inserts are tested in a micro-hydro Pelton machine. A specially constructed turbine test-bed, featuring two separately installed measuring units, allows for the partitioning and measurement of dissolved and undissolved air. In the case of the used Pelton machine, the results clearly identify different air detrainment processes. The undissolved air demand strongly depends on the particular casing insert and can be reduced by 90% through optimal flow condition using flow straighteners as insert. In contrast, the amount of dissolved air demand cannot be controlled by additional casing inserts. This can be explained due its different entrainment

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