The Technical & Economic Feasibility of Energy Recovery in Water Supply Networks

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Abstract. Water supply is a core service on which civilised society depends. It involves considerable energy consumption and, as a result, CO_2 emissions (in water treatment, pumping and monitoring) and economic costs. Treated water is most commonly supplied from a central storage reservoir by gravity throughout a catchment and this water must be supplied within satisfactory pressure bands. Where the pressure in water flow becomes too high, a Break Pressure Tank (BPT) is commonly installed in the network, whereby the pressure, kinetic and potential energy within the flow is dissipated to the atmosphere. These BPTs present an opportunity to recover energy from water supply networks by means of a hydropower turbine system, thereby improving the sustainability of the network without interfering with the water supply service. This paper presents the results of a preliminary technical and economic feasibility assessment of the energy recoverable from BPTs.

Key words
Energy Recovery, Water Supply, Hydro-power, CO_2 emissions, Sustainability.

1. Introduction
The supply of treated water in the western world is likely to be an unsustainable process in its current form. Considerable amounts of energy consumption and CO_2 emissions are inherent in the various treatment processes and supply processes involved. With the increasing global awareness of the impacts of energy consumption and CO_2 emissions on climate change, humankind, finite resources and the environment as a whole, efforts to reduce consumption and emissions in all sectors of society are underway.

The sustainability of the water supply process and its interaction with climate change has been shown to be of concern on a global scale for large urban centres (Jenerette & Larssen, 2006). Recent research in the water supply industry has identified key research questions in the area, such as: 'how do we develop and implement low energy water treatment processes' and 'can we optimise water supply within catchments' (Browne et al., 2010).

Many methods of improving the sustainability of water supply have been investigated. Methods aimed at reducing overall water demand and subsequently its associated energy consumption include: the reuse of grey water; water leakage reduction schemes; rain-water harvesting schemes; water metering and other water conservation policies (Rygaard et al., 2011).

Methods to reduce the energy consumption of individual water treatment and supply processes have also been investigated. These include the capture of by-products such as biogas for use in combined heat and power facilities, thereby reducing the energy needs of the treatment/supply process (Hernandez Leal et al., 2010). In addition the recycling of dried sludge pellets in co-firing combustion systems to produce energy has received attention in literature (Park and Jang, 2010).

This paper outlines the preliminary investigations of the Hydro-BPT project which is investigating another approach to reducing the energy consumption of the water supply process through the recovery of energy wasted in break pressure tanks (BPTs) on water supply distribution networks.

2. Technical Feasibility

A. Hydro-BPT Concept
Water supply distribution networks are designed under a number of criteria, including pressure. Water pressure within a water supply distribution system is required to fall within an upper and lower design limit. Too little pressure provides and unsatisfactory level of service to consumers and too high pressure increases the risk of