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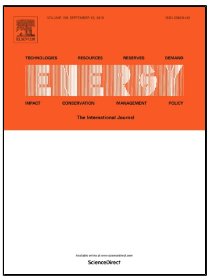

Energy Recovery from the Water Cycle: Thermal Energy from Drinking Water

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Energy Recovery from the Water Cycle: Thermal Energy from Drinking Water

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Abstract

Greenhouse gas (GHG) emissions contribute to climate change. The public water utility of Amsterdam wants to operate climate neutrally in 2020 to reduce its GHG emissions. Energy recovery from the water cycle has a large potential to contribute to this goal: the recovered energy is an alternative for fossil fuel and thus contributes to the reduction of GHG emissions. One of the options concerns thermal energy recovery from drinking water. In Amsterdam, drinking water is produced from surface water, resulting in high drinking water temperatures in summer and low drinking water temperatures in winter. This makes it possible to apply both cold recovery and heat recovery from drinking water. For a specific case, the effects of cold recovery from drinking water were analyzed on three decisive criteria: the effect on the GHG emissions, the financial implications, and the effect on the microbiological drinking water quality. It is shown that cold recovery from drinking water results in a 90% reduction of GHG emissions, and that it has a positive financial business case: Total Cost of Ownership reduced with 17%. The microbial drinking water quality is not affected, but biofilm formation in the drinking water pipes increased after cold recovery.

Keywords

Cold recovery; Greenhouse gas emissions; Drinking water; Microbiological water quality; Thermal energy

1. Introduction

It is generally accepted that emission of greenhouse gases (GHG) contributes to climate change. Already in 2007 the International Panel on Climate Change (IPCC) recommended to strive for an ambitious reduction of carbon dioxide-equivalent (CO_2) emission levels in order to stabilize global warming [1]. In 2013 the IPCC stressed again that continued emissions of GHG will cause further warming and changes in all components of the climate system. Limiting climate change will require substantial and sustained reductions of GHG emissions [2]. Based on the conclusions of the IPCC, targets and ambitions have been formulated at many levels, ranging from a worldwide level (United Nations) to a city level and public utility level, e.g. water utility Waternet in Amsterdam. Table 1 summarizes the targets set at these different levels.

Table 1. Climate change mitigation targets at different levels

Level	Organization	Targets	References
World-wide level	United Nations	• keep global temperature rise this century well below 2 °C above pre-industrial levels • pursue efforts to limit temperature increase further to 1.5 °C	3, 4
European level	European Union	• 40% cut in GHG emissions	5