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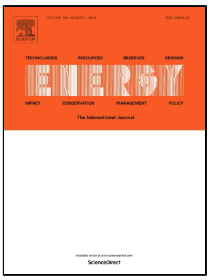

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Socioeconomic cost-benefit-analysis of seasonal heat storages in district heating systems with industrial waste heat integration

Simon Moser[1], Julia Mayrhofer[1], Ralf-Roman Schmidt[2], Robert Tichler[1]

ABSTRACT

Industrial waste heat is primarily available in summer months while district heating demand is greater in winter months. In order to shift heat potentials from summer to winter and thereby make the feed-in of industrial waste heat economically more attractive, the paper explores the use of waste heat with large-scale (seasonal) heat storage. This paper focuses on the case study of the industrial city of Linz (Austria), and demonstrates the advantages and disadvantages of seasonal heat storage. The interaction between the storage system with optimal cogeneration plant dispatch and industrial waste heat integration is explained. Furthermore, the most important parameters of the heat storage in order to achieve economic feasibility are highlighted. One main finding is that the number of annual cycles is crucial for a *seasonal* heat storage. The amortization period is computed to be about 20 years, and is shown to be extremely sensitive to changes in electricity, gas and CO_2 prices.

KEYWORDS

Seasonal heat storage, district heating, waste heat integration, CHP dispatch optimization.

1. INTRODUCTION

For 4th generation district heating networks, waste heat integration is expected to be a common design element [1]. With many practical examples in 2nd and 3rd generation district heating networks, integration of industrial waste heat into these networks is technically feasible. In Austria, the usage of waste heat from the paper industry, forest industry, steel industry, petrochemical industry and food and drinks industry can be observed. Nevertheless, significant thermal capacities and volumes remain unused due to the high flow temperatures of 2nd and 3rd generation district heating networks. Even after excluding low-temperature industrial waste heat, substantial potentials remain [2].

In many people's opinion, it is often assumed that waste heat is a free source of energy and therefore its utilization and integration in district heating networks is always economically efficient. However, it was demonstrated that the feed-in of waste heat is often associated with significant initial investments (upfront costs) and risks (economic uncertainty) for both the district heating company and the providing industry. [3] Moreover, the temperatures in 2nd and 3rd generation district heating networks imply that alternative uses of the waste heat (e.g. power generation on low efficiency levels) or preparation costs (e.g. electricity for heat pumps) are non-negligible [4].

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