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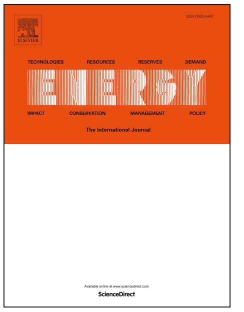

Optimization-based identification and quantification of demand-side management potential for distributed energy supply systems

Björn Bahl, Matthias Lampe, Philip Voll, André Bardow

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Title: Optimization-based identification and quantification of demand-side management potential for distributed energy supply systems

Authors: Björn Bahl[a], Matthias Lampe[a], Philip Voll[a], André Bardow[a]*

Affiliations: [a]Chair of Technical Thermodynamics, RWTH Aachen University, 52056 Aachen, Germany
*andre.bardow@ltt.rwth-aachen.de

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Abstract

A method is presented to identify the potential for demand-side management (DSM) in energy supply systems. Optimization of energy supply systems usually considers energy demands as fixed constraints. Thereby, possible changes on the demand side are neglected. However, demand changes can lead to a better overall solution. Thus, DSM measures should be integrated into the optimization of energy systems.
However, integrating optimization of DSM measures generally requires problem-specific process models. To avoid the need for problem-specific process models, we present a generic method applicable to various process domains. The method identifies a merit order of time steps with large potential for DSM and quantifies potential cost savings by DSM. Targets for demand-side measures are provided in a *DSM map* as guidance for the process engineer.
The merits of the novel method are illustrated for an industrial case study. In this study, 9.6% of all time steps are promising for DSM measures since they show a high sensitivity to demand changes. In particular, the method identifies non-intuitive time steps with high cost saving potential through DSM. We identify potential cost savings of more than 10% if DSM measures are implemented.

1 Introduction

We consider energy systems which consist of a distributed energy supply system (DESS) and a process system (Figure 1): The DESS converts primary and secondary energy to final energy required by the process system. The process system employs the final energy in technical processes, e.g., manufacturing.

Today, distributed energy supply system and process system are usually assumed to interact via a fixed interface: The processes demand a fixed amount of final energy in various forms, e.g., heating, cooling, or electricity; the demanded energy flows are provided by the DESS [**1**]. Fixed demands allow analyzing the distributed energy supply system and process system independently. Independent analysis of both systems is less complex and allows the use of domain-specific tools and case-specific models [**2**]. In practice, the interface also often represents industrial reality since distributed energy supply system and process system are usually operated by separate divisions in a company (or even two separate companies). However, independent analysis of the DESS and process system neglects any synergies and