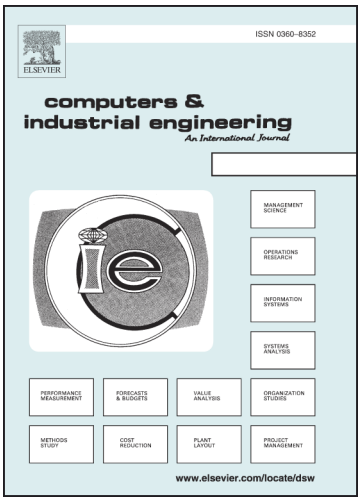
Accepted Manuscript



Simultaneously optimizing the capacity and configuration of biorefineries

Lars-Peter Lauven, Ingo Karschin, Jutta Geldermann

PII: S0360-8352(18)30329-2
DOI: https://doi.org/10.1016/j.cie.2018.07.014
Reference: CAIE 5314

To appear in: *Computers & Industrial Engineering*

Received Date: 28 March 2017
Accepted Date: 9 July 2018

Please cite this article as: Lauven, L-P., Karschin, I., Geldermann, J., Simultaneously optimizing the capacity and configuration of biorefineries, *Computers & Industrial Engineering* (2018), doi: https://doi.org/10.1016/j.cie.2018.07.014

Simultaneously optimizing the capacity and configuration of biorefineries

Lars-Peter Lauven*[a], Ingo Karschin [a] and Jutta Geldermann [a]

Address correspondence to: Lars-Peter Lauven, llauven@gwdg.de

[a]Chair of Production and Logistics, Georg-August-Universität Göttingen, 37073 Göttingen, Germany

Abstract

Advanced biomass conversion plants can replace fossil resources in the electricity, heat, transportation fuels and chemicals sectors, but they face specific challenges with regard to their economic operation. When choosing a capacity for a biomass conversion plant, economies of scale must be weighed against the transportation costs for the widely-distributed input materials.

Here, we model the problem of determining the optimal capacity for plants with a single product or a fixed set of products using a single optimization variable and two alternative economic objective functions. To identify the factors that most strongly influence economic plant operation, we perform a sensitivity analysis of various model parameters to determine their impact on the optimal solution using the Envelope Theorem. We also present an optimization approach for simultaneously planning the capacity and configuration of multi-product plants. By modeling economies of scale on a process-specific level, our nonlinear optimization approach makes it possible to determine the optimal configurations, and thus ranges of products, for changing plant capacities. An examination of the obtained feasible solutions shows that the optimization problem is neither convex nor concave.

Keywords

Applied optimization, Nonlinear Programming, Capacity planning, Process Industries