

Process and Economic Optimisation of a Milk Processing Plant with Solar Thermal Energy - DTU Orbit (08/11/2017)

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This work investigates the integration of solar thermal systems for process energy use. A shift from fossil fuels to renewable energy could be beneficial both from environmental and economic perspectives, after the process itself has been optimised and efficiency measures have been implemented. Based on the case study of a dairy factory, where first a heat integration is performed to optimise the system, a model for solar thermal process integration is developed. The detailed model is based on annual hourly global direct and diffuse solar radiation, from which the radiation on a defined surface is calculated. Based on hourly process stream data from the dairy factory, the optimal streams for solar thermal process integration are found, with an optimal thermal storagetank volume. The last step consists of an economic optimisation of the problem to determine the optimal size of the collector field and tank. The results show that solar thermal heat can considerably reduce the operating costs of the dairy factory, even in the North European climate. For the analysed factory the optimal process streams to be partially fuelled by solar energy was found to be hot air to the spray, where the operating costs could be reduced by 9 % while having a payback time of 5.5 years.

General information

State: Published

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Pages: 1347–1352

Publication date: 2016

Host publication information

Title of host publication: Proceedings of the 26th European Symposium on Computer Aided Process Engineering

Volume: 38

Publisher: Elsevier Science

Editors: Kravanja, Z., Bogataj, M.

ISBN (Electronic): 978-0-444-63428-3

Series: Computer - Aided Chemical Engineering

Volume: 38

ISSN: 1570-7946

Main Research Area: Technical/natural sciences

Conference: 26th European Symposium on Computer-Aided Process Engineering, Portorož , Slovenia, 12/06/2016 - 12/06/2016

Solar Thermal, Process Integration, Milk Powder, Economic Optimisation

DOIs:

10.1016/B978-0-444-63428-3.50229-0

Publication: Research - peer-review › Article in proceedings – Annual report year: 2016