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Algorithmic maximization of energy productivity to achieve net-zero emissions for production sites

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Abstract

The development of transformation concepts aimed at achieving net-zero emissions for production sites represents a complex planning task. In this context, mathematical programming has been demonstrated to be an effective methodology. Current investment and operation planning approaches neglect the economic realities of production sites by focusing solely on greenhouse gas emission reduction. Therefore, this article presents a mathematical programming approach for the maximization of the energy productivity of a production site. The integration of production processes and supply systems in a unified modeling approach results in economically viable solutions. The approach is validated by its application to the ETA Research Factory.

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Keywords: mathematical optimization; production sites; transformation concepts; energy productivity; net-zero emissions;

1. Main Text

A study that is based on mathematical optimization is based on these elements: 1. description of the use case, motivation and estimated scenarios 2. description of the applied modelling, simulation and solution methods or heuristics 3. presentation of the study outcome 4. discussion of the study outcome and in best case derivation of clear influencing metrics of the study outcome 5. critical analysis influencing elements of the study (scenario, modelling, heuristic)

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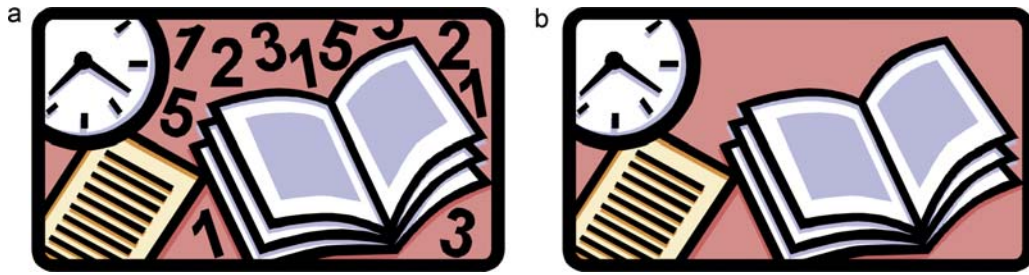


Fig. 1. (a) first picture; (b) second picture.

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$$X_r = \dot{Q}_{rad}'' / (\dot{Q}_{rad}'' + \dot{Q}_{conv}'')$$

$$\rho = \frac{\vec{E}}{J_c(T = \text{const.}) \cdot \left(P \cdot \left(\frac{\vec{E}}{E_c} \right)^m + (1 - P) \right)} \quad (1)$$

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References

- [1] Gilbert Fridgen, Robert Keller, Marc-Fabian Körner, Michael Schöpf, [A holistic view on sector coupling](#), Energy Policy 147 (2020) 111913. doi:10.1016/j.enpol.2020.111913.
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