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Authors: Nicolas Francart, Tove Malmqvist, Pernilla Hagbert

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Title: Climate target fulfilment in scenarios for a sustainable Swedish built environment beyond growth

Authors: Nicolas Francart^a, Tove Malmqvist^{a *}, Pernilla Hagbert^a

^a: KTH Royal Institute of Technology

Postal address: Kungliga Tekniska Högskolan, SE-100 44 Stockholm Sweden

*: corresponding author.

E-mail addresses:

Nicolas Francart: francart@kth.se

Tove Malmqvist: tove.malmqvist@abe.kth.se

Pernilla Hagbert: pernilla.hagbert@abe.kth.se

Highlights

- A model was built to estimate the climate impact of the built environment in four low-growth backcasting scenarios.
- Strategies to reach an emission quota and their consequences in terms of energy use and embodied emissions were examined.
- The results highlight impactful strategies for discussion, such as a low-emission energy mix and space optimization.
- Goal conflicts can arise, such as a tradeoff between reducing energy use and embodied emissions from renovation.

Abstract: *This paper explores opportunities for the built environment to fulfill a far-reaching greenhouse gas (GHG) emission target in Sweden in 2050, in a context of low or no economic growth. A spreadsheet model was created, allowing for a quantitative estimation of GHG emissions and operational energy use for the built environment. Building on previous qualitative descriptions of four future scenarios, the model was run to investigate what reaching the target would require in each scenario. The results can inform policy discussions and provide insights on what strategies appear to be significant, and what they entail in terms of operational energy use in 2050 and cumulated embodied emissions from investments prior to 2050. It thus appears particularly important to decarbonate the energy mix and reduce floor areas through space sharing and optimization. When emission factors for heat and electricity are very low, the climate impact of construction materials becomes an important issue, on par with operational energy use, and strategies aimed at improving construction processes or avoiding new construction gain relevance. Extensive renovation for energy efficiency exhibits in this case a tradeoff between embodied emissions from prior investments and energy use, as decreasing one means increasing the other.*

Keywords: *backcasting scenarios, greenhouse gas emissions, built environment, embodied emissions, operational energy use*

1 Introduction and aim of the study

Imagining future societies is both a relevant issue for policy and planning and a key research task, requiring explorative work on how societies can keep within planetary boundaries (Rockström et al., 2009; Steffen et al., 2015) and achieve a development that is both environmentally safe and socially just (Raworth 2012). Researchers and planners need to highlight potential conflicts between different sustainability goals, as well

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