The effects of the life span of products in LCA
A case study for dwellings

Arjen Meijer & André F. Thomsen

OTB Research Institute, Delft University of Technology, Delft, the Netherlands

Abstract

In life cycle assessment (LCA), the life span of a product can influence the environmental performance of that product, especially when its use phase has a significant contribution to the total performance. This is for example the case for dwellings, where energy consumption for heating and maintenance are important factors. It is common in dwelling LCAs to assume a default life span of the dwelling of 75 year. From a housing stock point of view, this may be in practice far too short. Regarding the current building, demolition and replacement rates in most Western European countries, an average dwelling life span of at least 400 years is required to keep the current housing stock fulfilling the actual level of housing provision.

To assess the effects of the dwelling life span on the environmental performance, we calculated the effect of life cycle extension on the environmental performance of the Dutch standard reference dwelling and compared the results with the effects of using different building materials with different life cycles, and different energy conservation options. The results may be useful in the discussion about the impact of life cycle extension and whether to focus on the building materials or on decreasing environmental effects of the use phase by e.g. energy conservation.

Introduction

The lifetime of houses in LCA calculations is often assumed to be 75 year by default. However, the lifetime of Dutch houses is in practice much longer. According to the current housing stock and the number of houses built per year, a dwelling lifetime of 400 years is a better estimation for the Netherlands. This has a possible effect on the ratio between environmental effects associated with the building phase and with the use phase

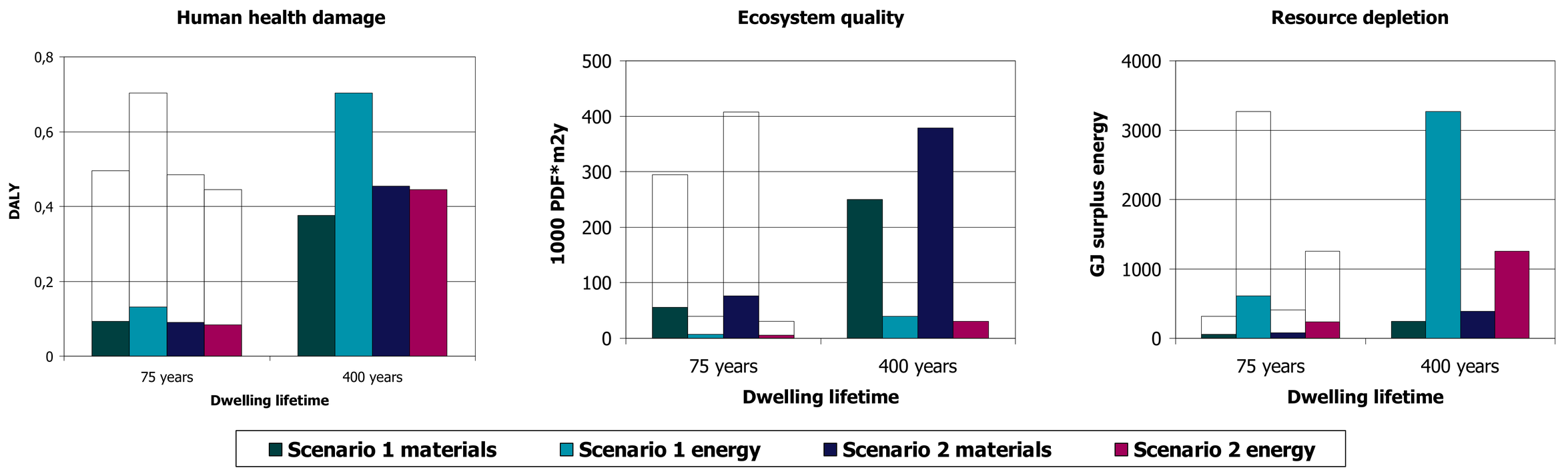
Methodology

- Life cycle assessment of Dutch single-family row house with lifetime of 75 years and of 400 years
- Two scenarios compared: reference and sustainable scenario
- Data for building materials taken from Ecoquantum and Ecoinvent 2.0
- Production of building materials, replacement of building materials during use phase and energy consumption during use phase taken into account
- Eco-indicator 99 impact assessment methodology

Scenarios

	Scenario 1 Reference	Scenario 2 Sustainable
Ventilation	Default	With heat exchanger
Photovoltaic panels	No	2 kW_p multi-Si
Solar collector	No	Yes
Heat pump	No	Yes
Dwelling frame construction	Concrete/sand-lime bricks	Wood

Results



Cumulative effects
Transparent bars depict linear extrapolation from 75 year to 400 year

Conclusions

- Ratios between environmental effects of materials and energy consumption do not change significantly when dwelling lifetime is extended from 75 years to 400 years.
- This is because of the large contribution of building materials which has to be replaced regularly during the dwelling life time, such as ceramics, mortar and copper.
- The effects of future optimisations during the dwelling life cycle, e.g. better energy conserving measures or improved production methods, can affect the results of the comparison.
- Building materials with a long lifetime (e.g. foundation, structural walls) have a smaller influence than building materials with a short lifetime (e.g. windows, installations) on the change of ratio between building phase and use phase when the dwelling lifetime increases.

Contact: a.meijer@tudelft.nl

TU Delft Delft University of Technology

Challenge the future