

# The role of timber products in reducing the environmental impact of buildings in South Africa: A life cycle assessment study

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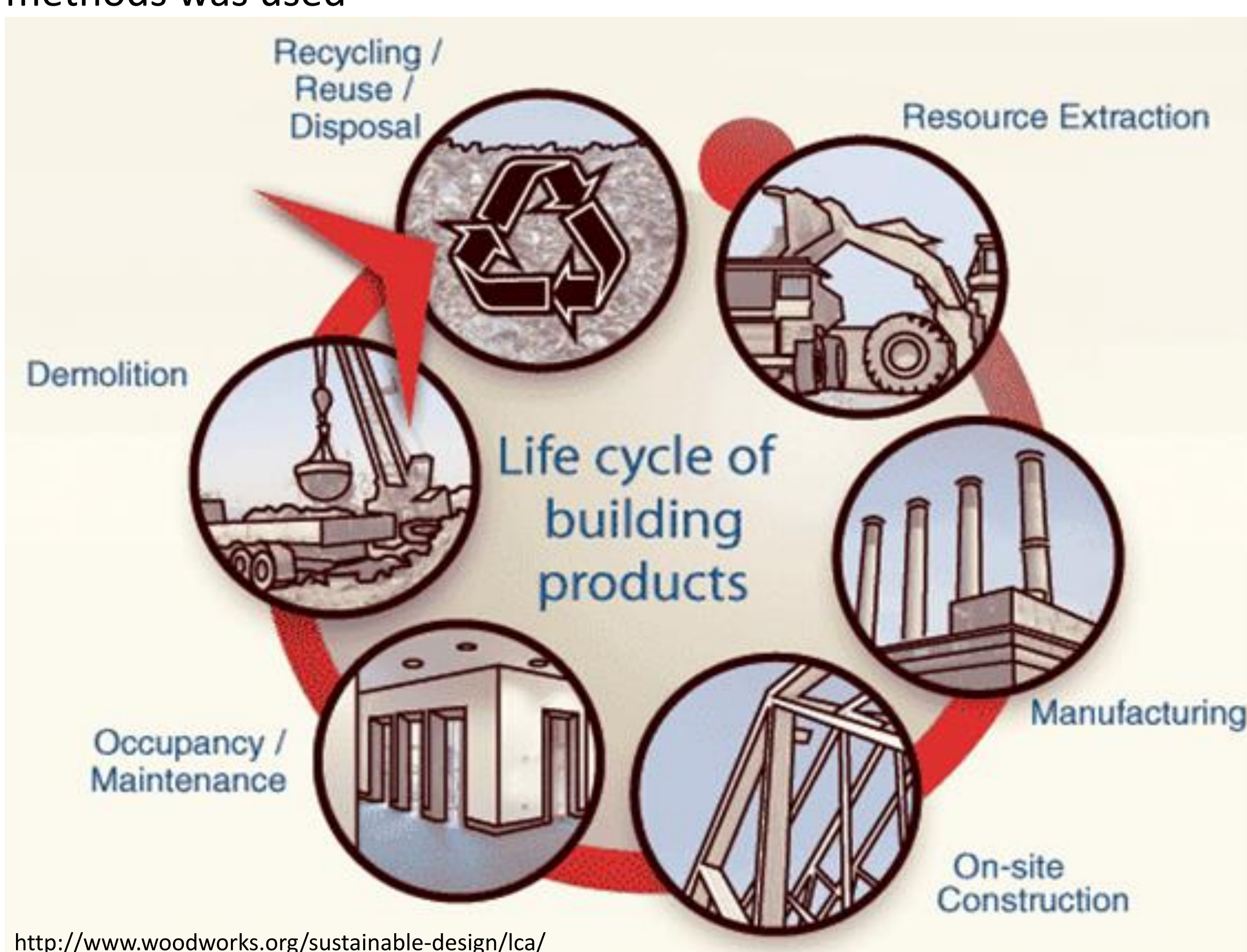
**ABSTRACT:** Buildings are major emitters of CO<sub>2</sub> and contribute significantly to climate change. A growing awareness of the environmental footprint of buildings and the necessity to lower greenhouse gas emissions has led to the implementation of green building practices and introduction of rating tools that measure the environmental impact and sustainability of buildings since the 1990s. Numerous studies based on life cycle assessment (LCA) have shown that substituting steel, concrete and brick materials with renewable and sustainable wood products can significantly lower the environmental impact of a building. LCA is a method of measuring the environmental impacts of a product over its entire life, e.g. from the extraction of raw materials to final disposal. The aim is to identify, quantify and assess the environmental impact of energy and materials used, and emissions and waste released throughout the life of a product. For building products LCAs can help to compare various products and to assess their environmental performance and sustainability. South Africa was the first country in Africa to implement a locally developed green building rating tool and to have a growing number of rated green building projects. However, the benefits of wood, as a local, renewable and sustainable resource have so far largely been overlooked. At present, more than 70% of all sawn lumber in South Africa is used in buildings, mainly in roof structures. Lately, light steel frame trusses have gained market share. In this study we compare several roof truss systems (i.e. timber and steel) typically found in a low income house design in South Africa using the LCA method. We discuss their environmental performance and address issues regarding the availability of country specific life cycle inventory (LCI) data that is used to perform an LCA.

## SCOPE & OBJECTIVE:

- To compare simplified roof truss systems typically found in low income housing in South Africa made of light gauge steel and wood from a life-cycle perspective
- To evaluate the potential environmental impact of the different roof structures using life-cycle assessment (LCA) methodology
- To assess available life-cycle inventory (LCI) data sources for LCA studies in South Africa

## METHODOLOGY:

- A detailed description of the LCA framework is available in the ISO14040 "Environmental Management" series
- Though, many of their recommendations are above and beyond the scope of this study, sections of the guidelines relevant to this study were followed
- The functional unit: quantity of materials required to construct a roof for a RDP house (square footprint of 42m<sup>2</sup>) designed for a 50 year life span in the Western Cape
- The truss systems were designed by a MiTek engineer using their software
- LCI data was mainly taken from the ecoinvent 3.1 database in form of global datasets, adjusted for regional specificity (e.g. electricity or forestry operations) where applicable and possible using openLCA software
- For life-cycle impact assessment (LCIA) the CML 2001 (baseline) methods was used

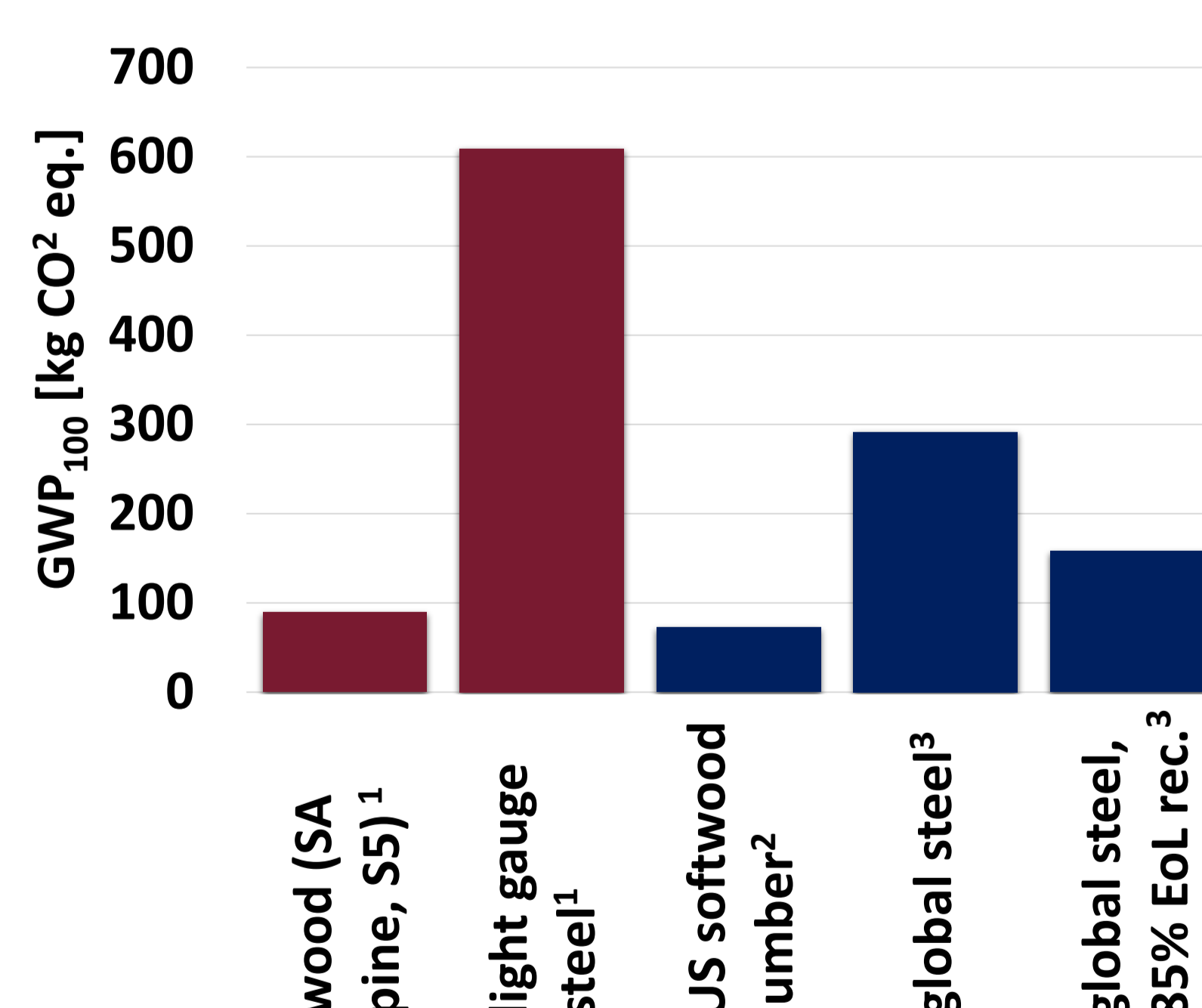
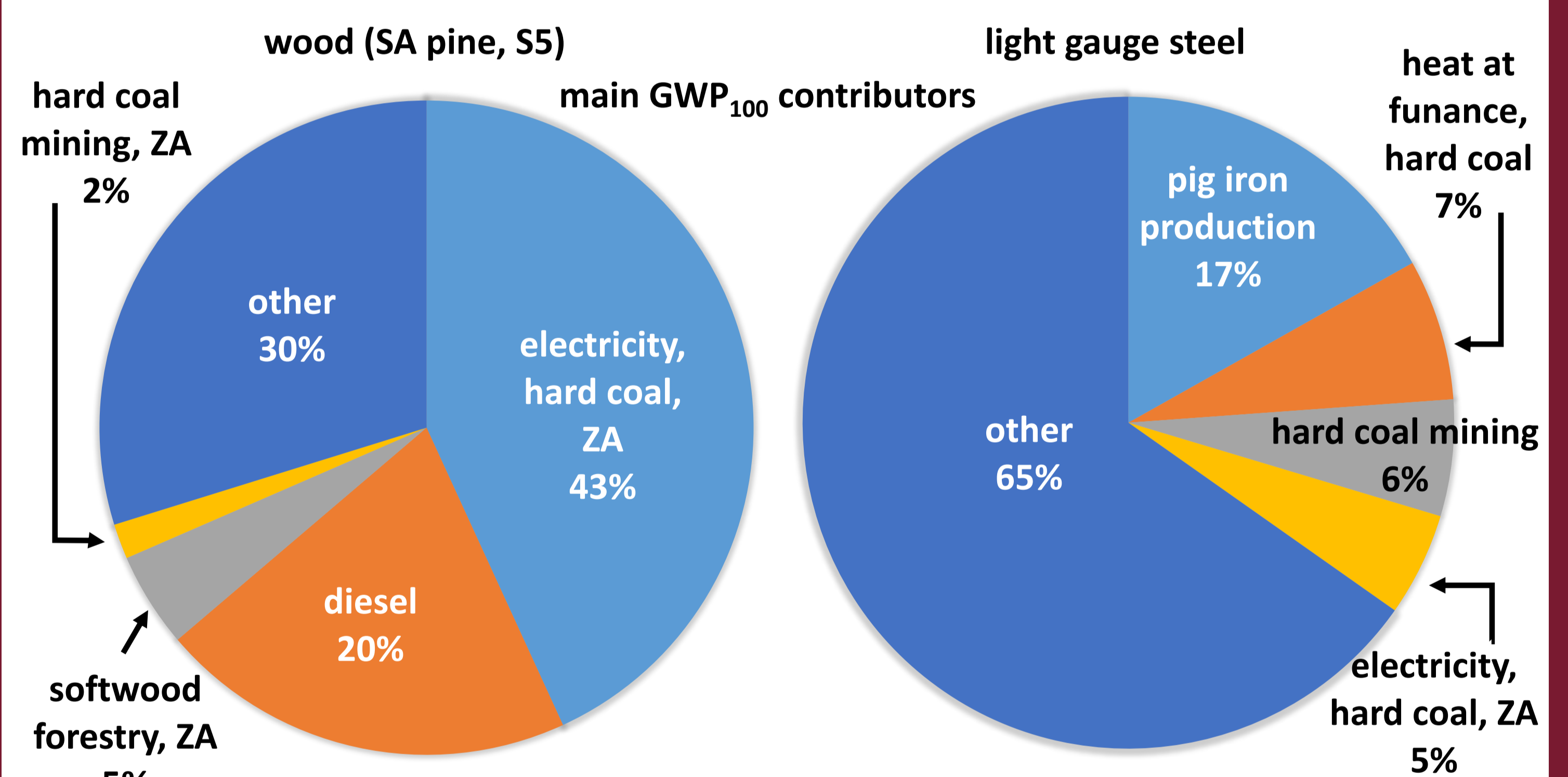


<http://www.woodworks.org/sustainable-design/lca/>

## RESULTS:

### Material requirements and potential GWP of a 42m<sup>2</sup> house with cement tiled roof

Truss material	No. of trusses	Amount	GWP <sub>100</sub>
wood (SA pine, S5)	10	292 kg 0.65m <sup>3</sup>	89.4 kg CO <sub>2</sub> eq.
light gauge steel	7	118 kg	608.9 kg CO <sub>2</sub> eq.



#### Data sources:

- this study, based on the ecoinvent 3.1 (<http://www.ecoinvent.org>) and AusLCI (<http://alcas.asn.au/AusLCI/index.php/Datasets>) databases
- ecoinvent 3.1 database
- data provide by World Steel Association (<http://www.worldsteel.org/publications/position-papers/lca.html>)

#### LIMITATIONS:

- Study in initial stage, results only represent the major material for truss components, without any end-of-life (EoL) considerations, modelled wood has not been preservative treated

#### CONCLUSION:

- Increasing the use of timber in the South African building landscape can help reduce the environmental footprint caused by building products
- LCA is a valuable tool to gain a holistic view of the potential environmental footprint of building products over their entire life-cycle
- LCA can only be as good as the data it is based on
- Need for development of regional LCI data to assess environmental impacts in an (South) African setting