

CLIMATE CHANGE AND BIO-CONCRETES IN BUILDINGS: DEVELOPMENT OF LOW CARBON MATERIALS FOR FAÇADE PANELS

LUCAS ROSSE CALDAS^{1*}, M'HAMED YASSIN RAJIV DA-GLORIA¹, DANIELE JUSTO SANTOS¹, VANESSA MARIA ANDREOLA¹, ROMILDO DIAS TOLEDO FILHO¹

¹ Federal University of Rio de Janeiro, COPPE, Centro de Tecnologia, Ilha do Fundão, Rio de Janeiro, Brazil, CEP 21945-970
*Corresponding author; e-mail: lrc.ambiental@gmail.com

INTRODUCTION

Thermal comfort, energy consumption and consequently CO₂ emissions in buildings are heavily affected by weather conditions. The conventional constructive systems used in Brazil (ceramic and concrete masonry) will be compared with new bio-based constructive system (called as bio-concretes), developed in Laboratory, made of cement and forest wastes. In order to evaluate the climate change impacts, the carbon footprint of buildings will be done, considering the biogenic carbon of the forest wastes. As results, it is expected to know the CO_{2e} emissions reduction potential in the use of bio-concretes both in the construction level and in the energy consumption of the buildings.

BACKGROUND

- Buildings are responsible for a large share of the energy consumption and CO₂ emissions worldwide.
- The Brazilian housing deficit.
- Bio-based materials (forest wastes) used in buildings as potentials CO₂ sinks.
- The differences between carbon footprint methodologies.
- The impact of climate change on thermal comfort conditions and on cooling energy demand and CO_{2e} in Brazilian social housings with focus on building's façades.

FOREST WASTE MATERIALS AND BIO-CONCRETE



Figure 1: Forest waste materials and biogenic carbon.

METHODOLOGY

- Experimental approach (mechanical, thermal, durability performance) in Laboratory.
- Life cycle assessment and carbon footprint.
- Thermal energy simulation – DesignBuilder and EnergyPlus.
- IPCC A2 scenario was selected to be used in the study.
- The Climate Change World Weather File - future typical meteorological years - 2020, 2030, 2050 and 2080.

RESULTS

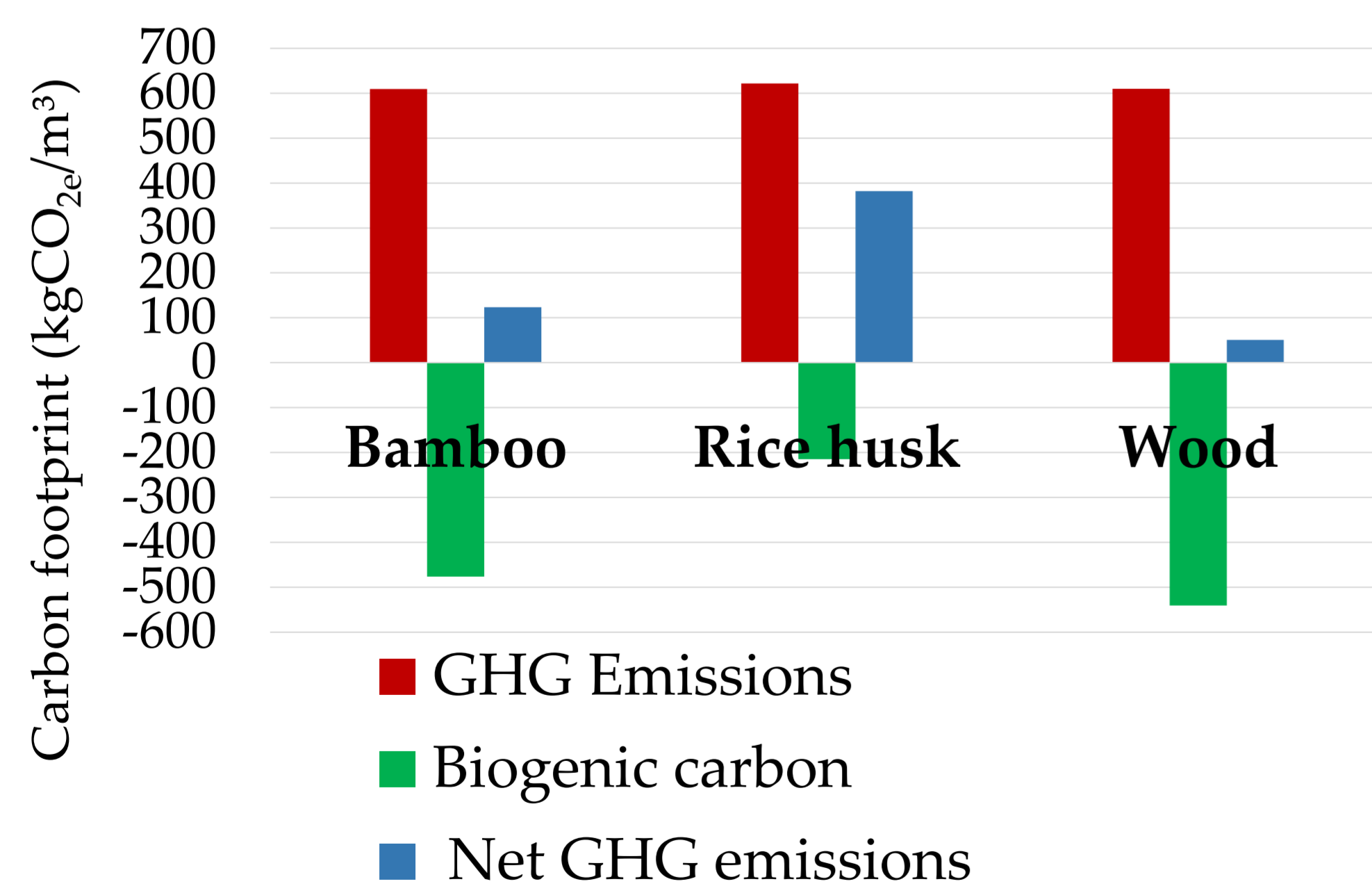


Figure 2: Comparison between carbon footprint of the three bio-concretes.

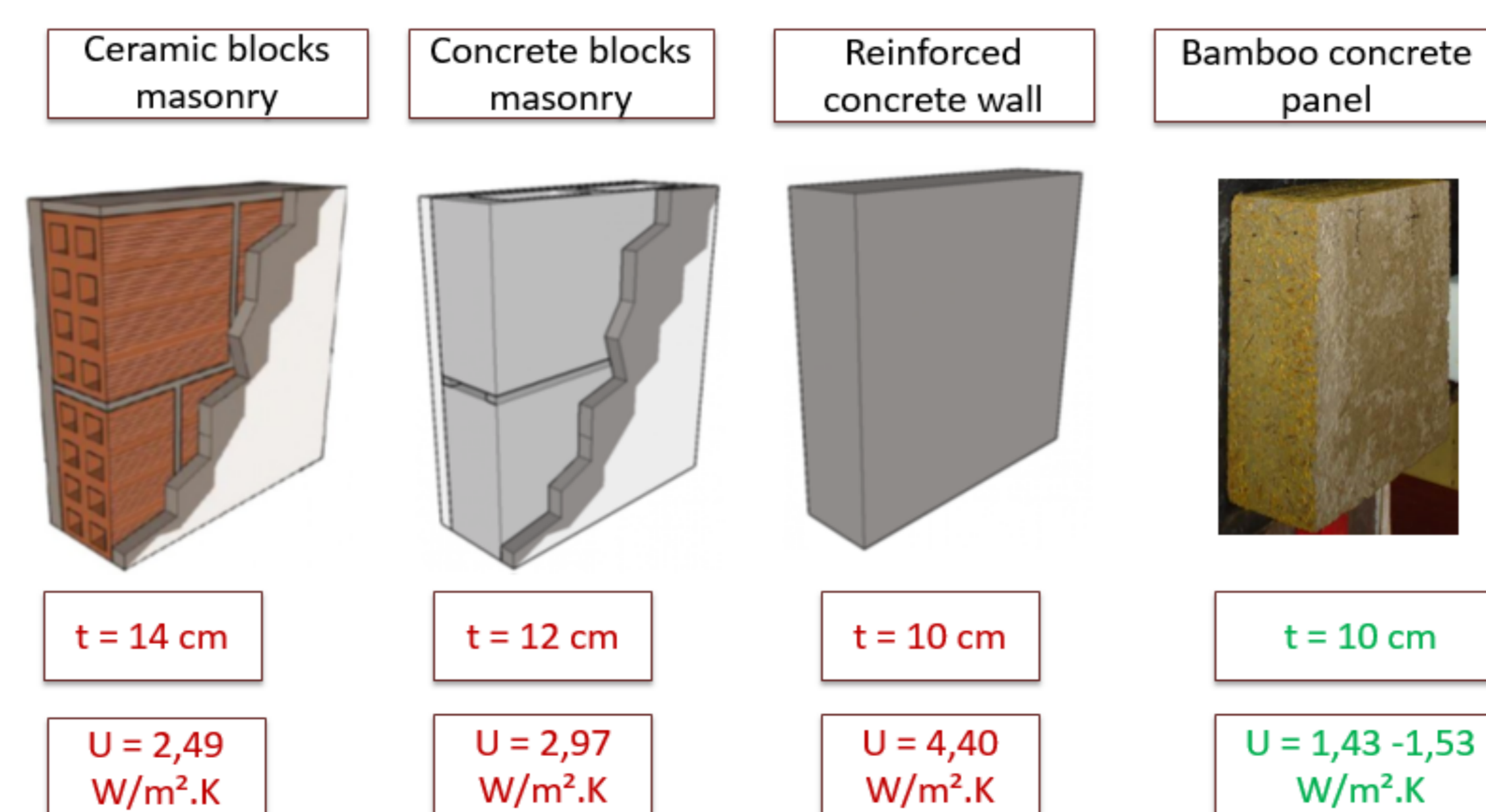


Figure 3: Comparison between bio-concrete and different Brazilian constructive systems.

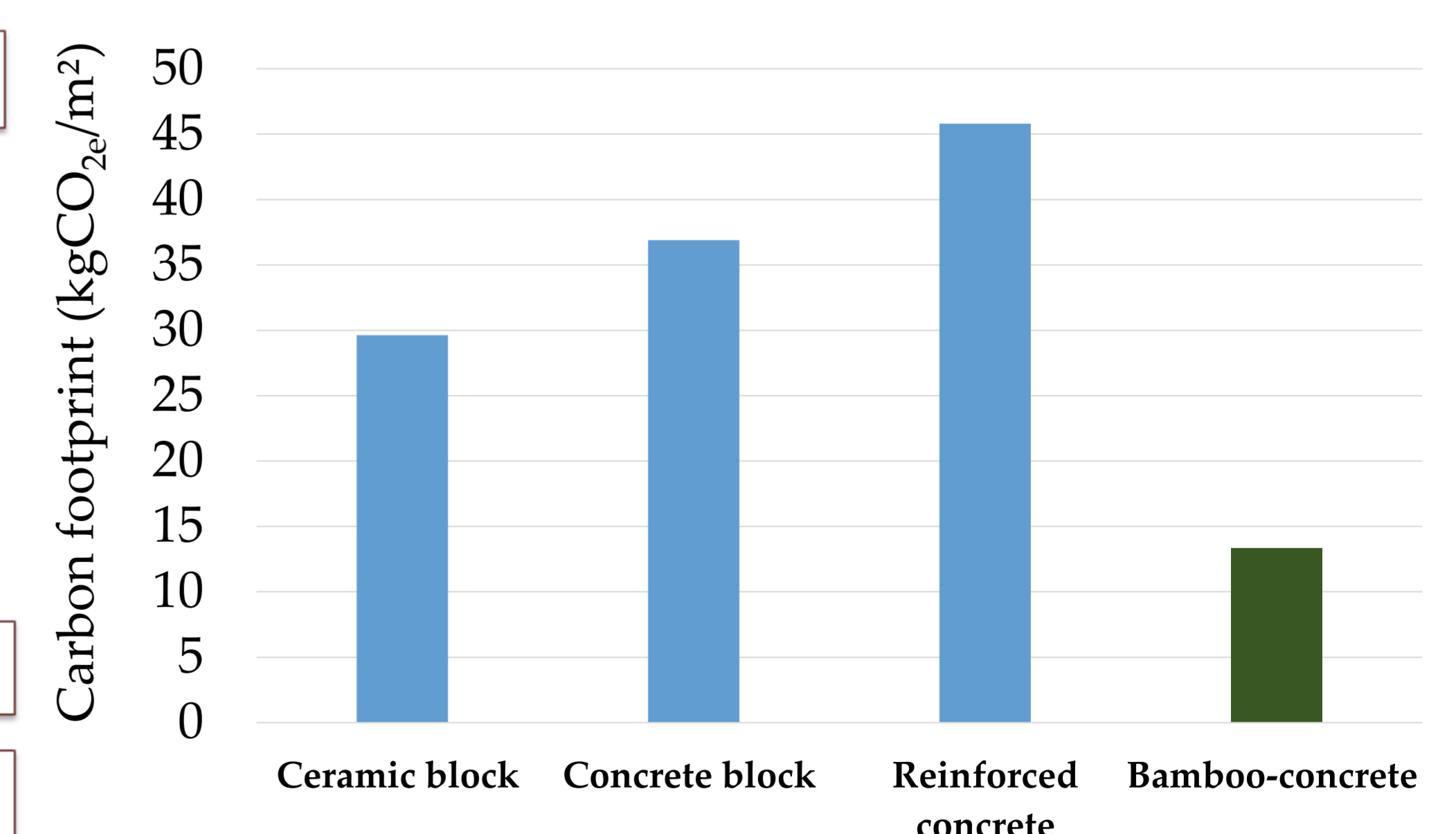


Figure 4: Carbon footprint of bamboo bio-concrete and other constructive systems.

CONCLUSIONS AND FUTURE RESEARCH

- Potential benefits of bio-concretes in terms of CO_{2e} emissions reduction.
- Evaluation of the thermal performance of bio-concretes as façade panels.
- The energy consumption, the CO_{2e} emissions during the usage stage of buildings – dynamic thermal energy simulation, considering the climate change weather changes.

ACKNOWLEDGMENTS: