

# Energy Storage Solutions: An Analysis of Coconut Oil as a Renewable Phase Change Material and its Supercooling Dynamics

Matheus N. Guedes, Sofia R. Passalacqua, Maedson Silvino, Lucas Fernandes de Lima Lira, Simone Monteiro, Taygoara F. Oliveira, Antonio Cesar Pinho Junior  
Mechanical Engineering Department - University of Brasília - Brazil Corresponding author: simonems@unb.br

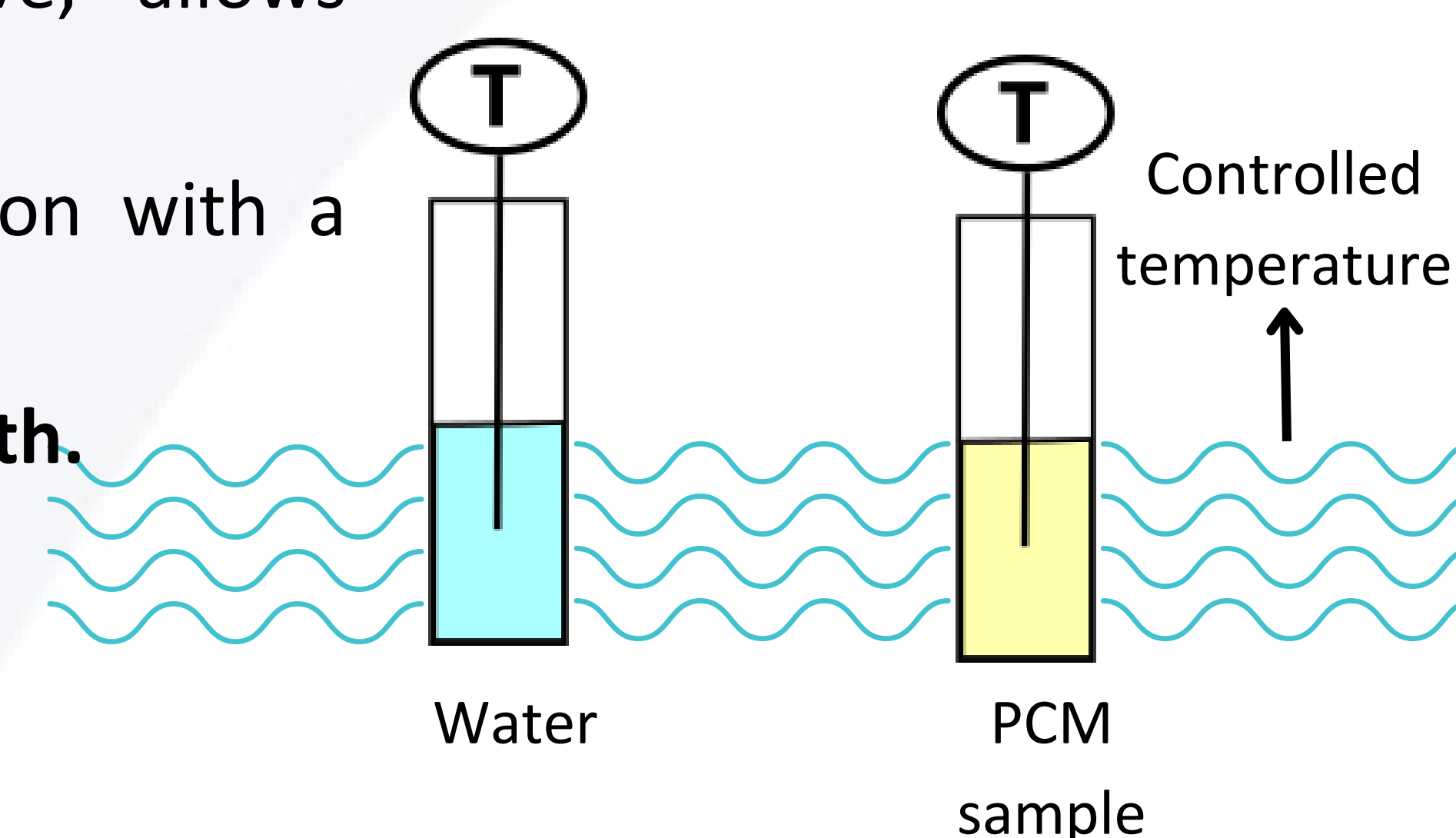
## INTRODUCTION

- Phase change materials (PCMs) stores energy through phase transition.
- PCMs can reduce electrical energy consumption of buildings
- Buildings are responsible up to 40 % of the global electrical demand.



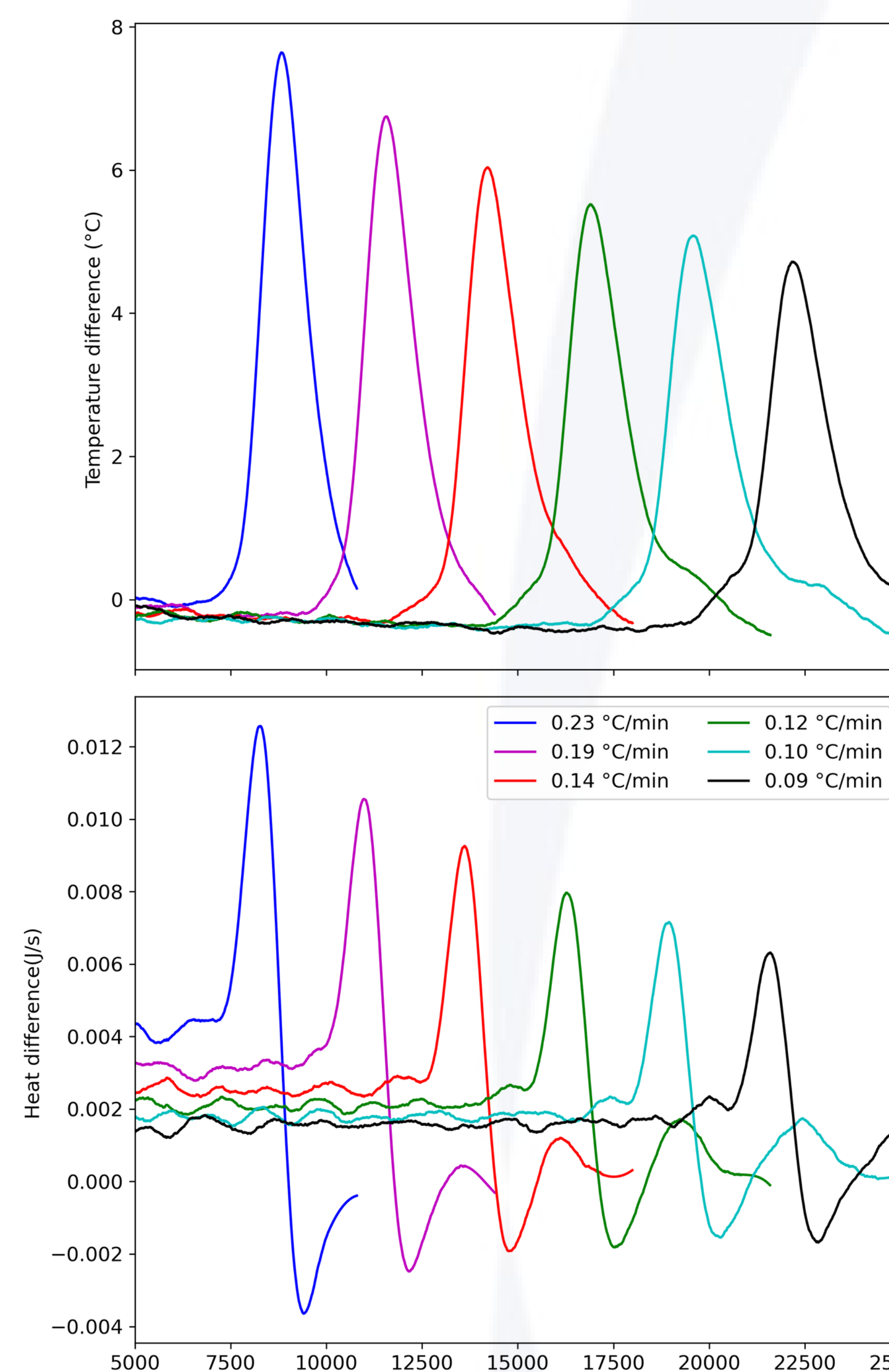
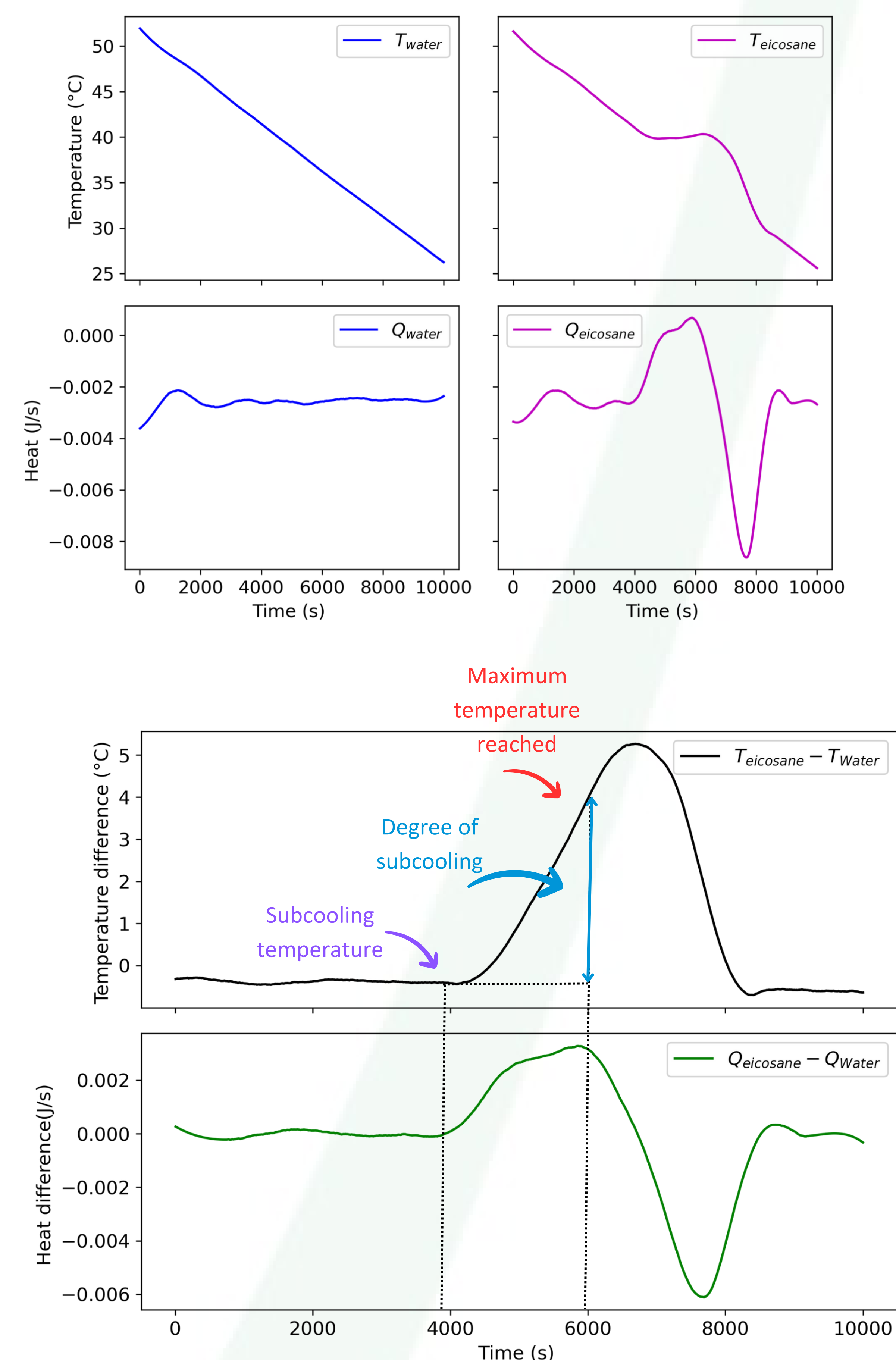
## METHODOLOGY

- The **T-history methodology**: simple, cost-effective, allows study heat-transfer effects in larger samples
- Thermophysical properties estimated by comparison with a standard material
- Materials as subjected to **controlled temperature bath**.

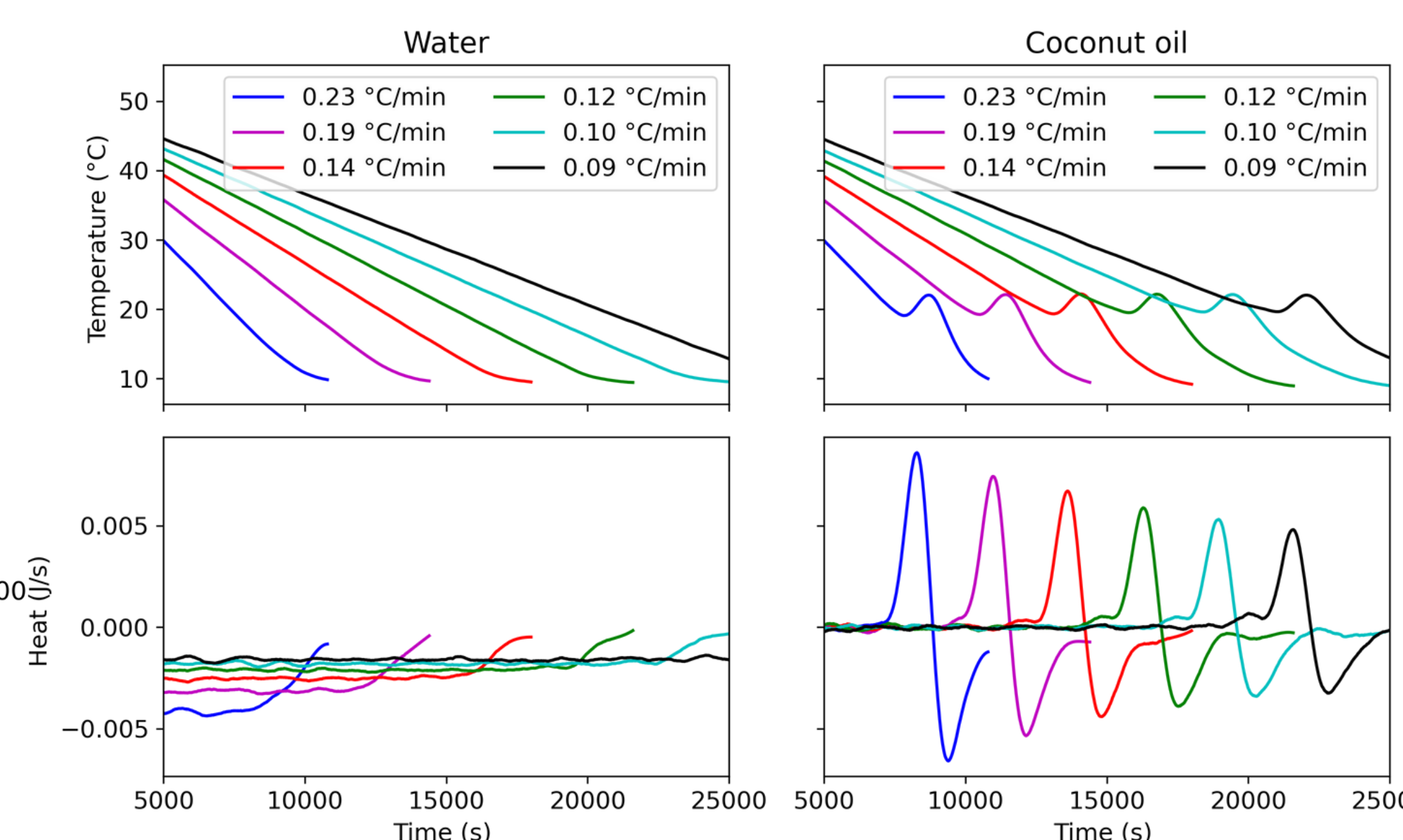


## RESULTS

- N-eicosane was used to validate the setup
- To take into account only the phase, it was calculated the difference between sample and water temperatures and heats
- $\Delta T$  starts negative because of the difference of cp. The difference increases due to subcooling and later due to of start of solidification



- In the conditions studied, the degree of subcooling decreased when slower cooling rates were applied
- Lowering the degree of subcooling is important because the energy used to reach the solidification from a subcooled state is not stored
- For application in the building sector, the temperature fluctuations may be even lower than the ones studied in this work. In this way, subcooling might not be a limiting factor for this kind of application



## CONCLUSION

- The temperature conditions to which vegetable oils are subjected influence their capability to store energy
- Future works might investigate the use of additive to mitigate supercooling and also oils fractionation to obtain PCMs with tailor-made properties