



Economic and Environmental Impact of Insulation types in Residential Buildings: A Comparative Study

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Introduction

As the UK is on route to achieving net zero by 2050, this dissertation acted as a base comparative study for heating oil-fuelled dwellings in the UK (1.5 million of the overall housing stock) (Garside, 2020).

The UK government currently only recommends conventional insulation materials for best retrofit practice.

Table 1. U values of studied materials

U values	
Wood fibre	0.19 W/m2K
Straw	0.1 W/m2K
Expanded polystyrene	0.12 W/m2K

Project Aims

The aim of this study is to demonstrate the viability of natural insulation materials as alternatives to conventional ones, fill knowledge gaps for homeowners and contractors and contribute to the 2050 net-zero goal by quantifying emissions impact.

Economic analysis

Insulating homes can generate over 140,000 jobs, potentially boosting the economy by up to £7 billion a year by 2030, despite a predicted workforce shrinkage post-2050 (Harvey, 2022)&(CLC, 2021).

Insulation can reduce health costs by mitigating respiratory illnesses caused by damp, mould, and drafts (WHO, 2018).

Furthermore, it can decrease the UK's reliance on foreign fossil fuels, reducing exposure to price volatility and geopolitical instability (Bolton, 2022).

Operations emissions

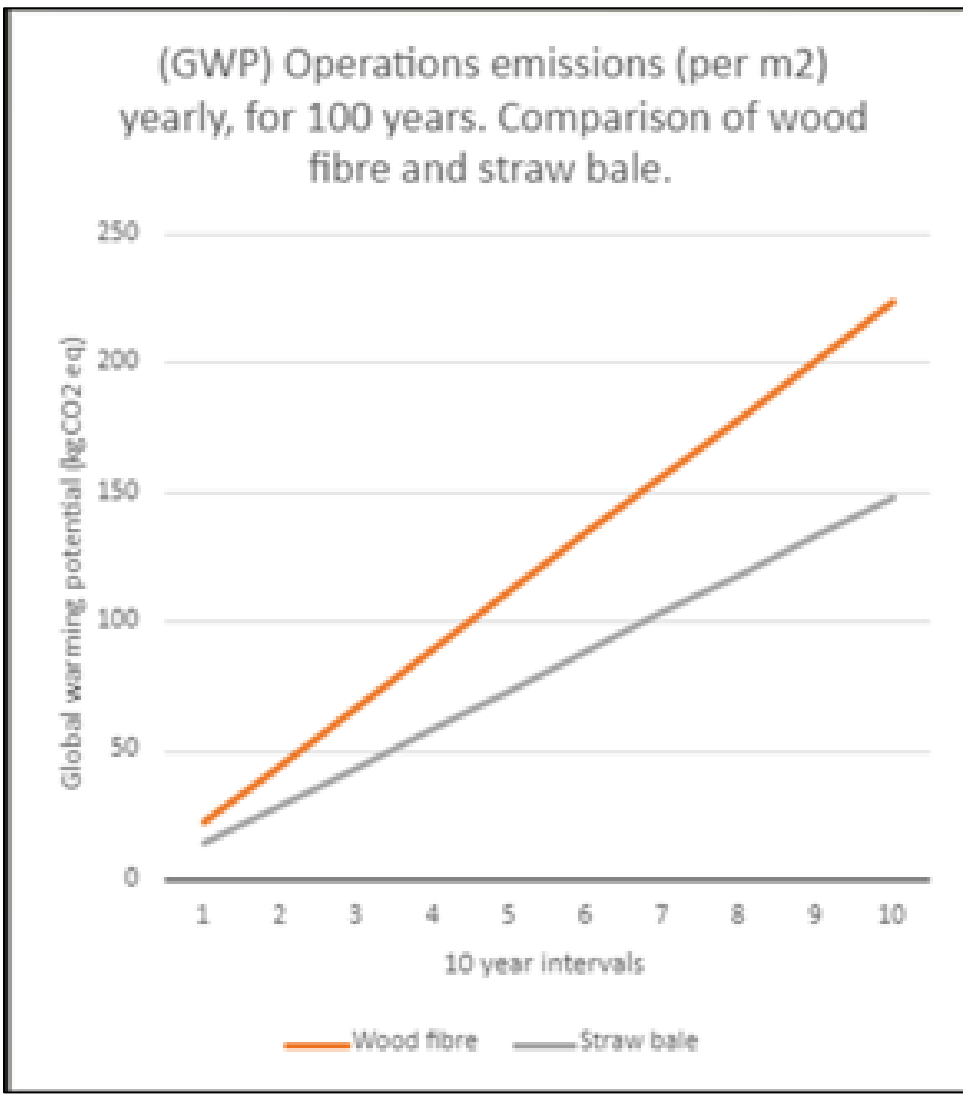


Figure 1. Operations emissions over 100 years.

Straw bale produces approximately 75kgCO2 less than wood fibre over 100 years .

Heating oil savings

Based on an assumptions of: floor area between 99-115m2, 20-year time scale

Table 2. U values of studied materials

Heating oil loss (litres)	
Poorly insulated	17176
Well insulated	2140

Embodied carbon

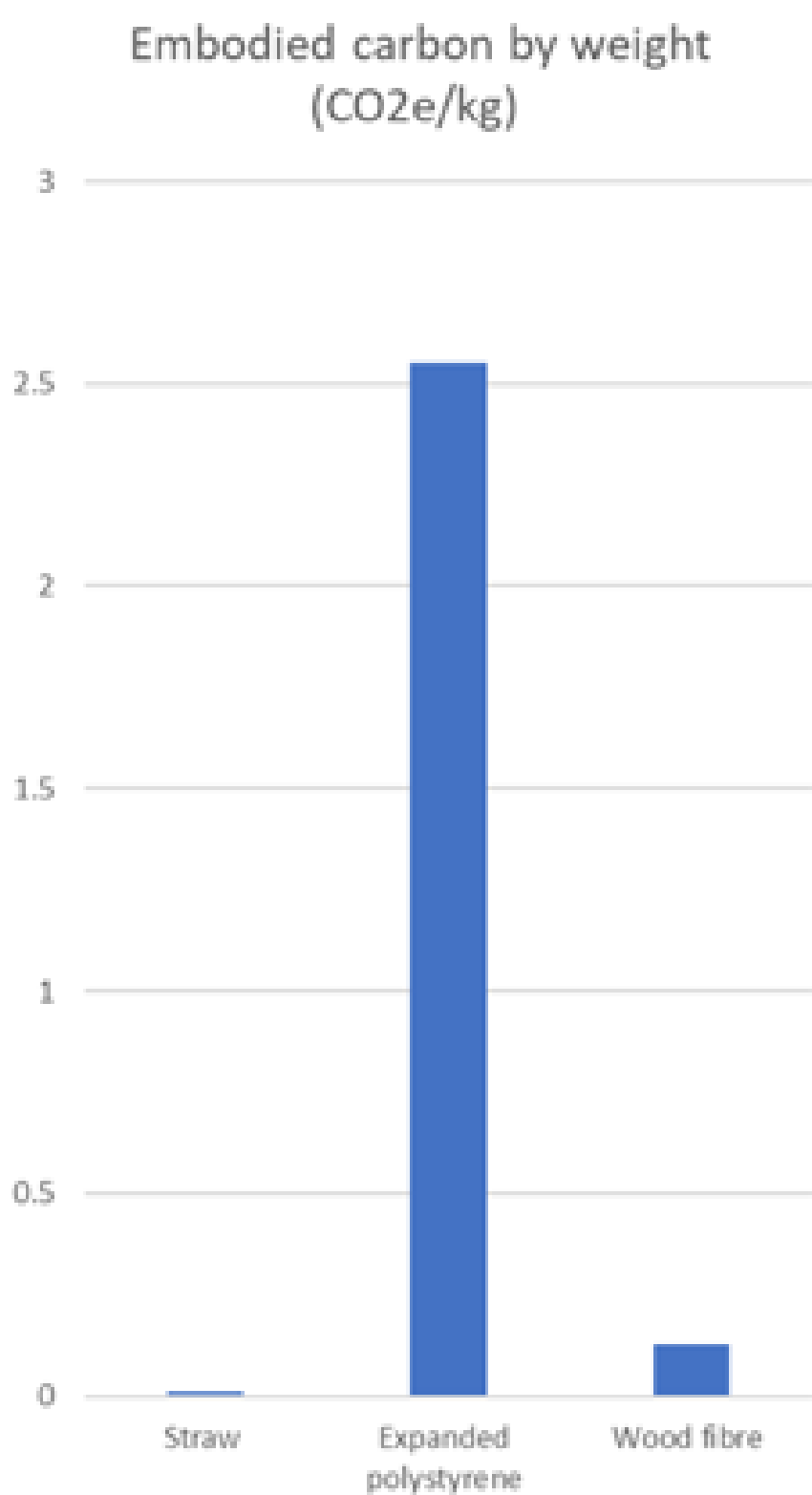


Figure 2. Embodied carbon by weight.

Straw and wood fibre have significantly lower embodied carbon (approximately 2.25 CO2e/kg less) than expanded polystyrene.

Lifecycle assessment

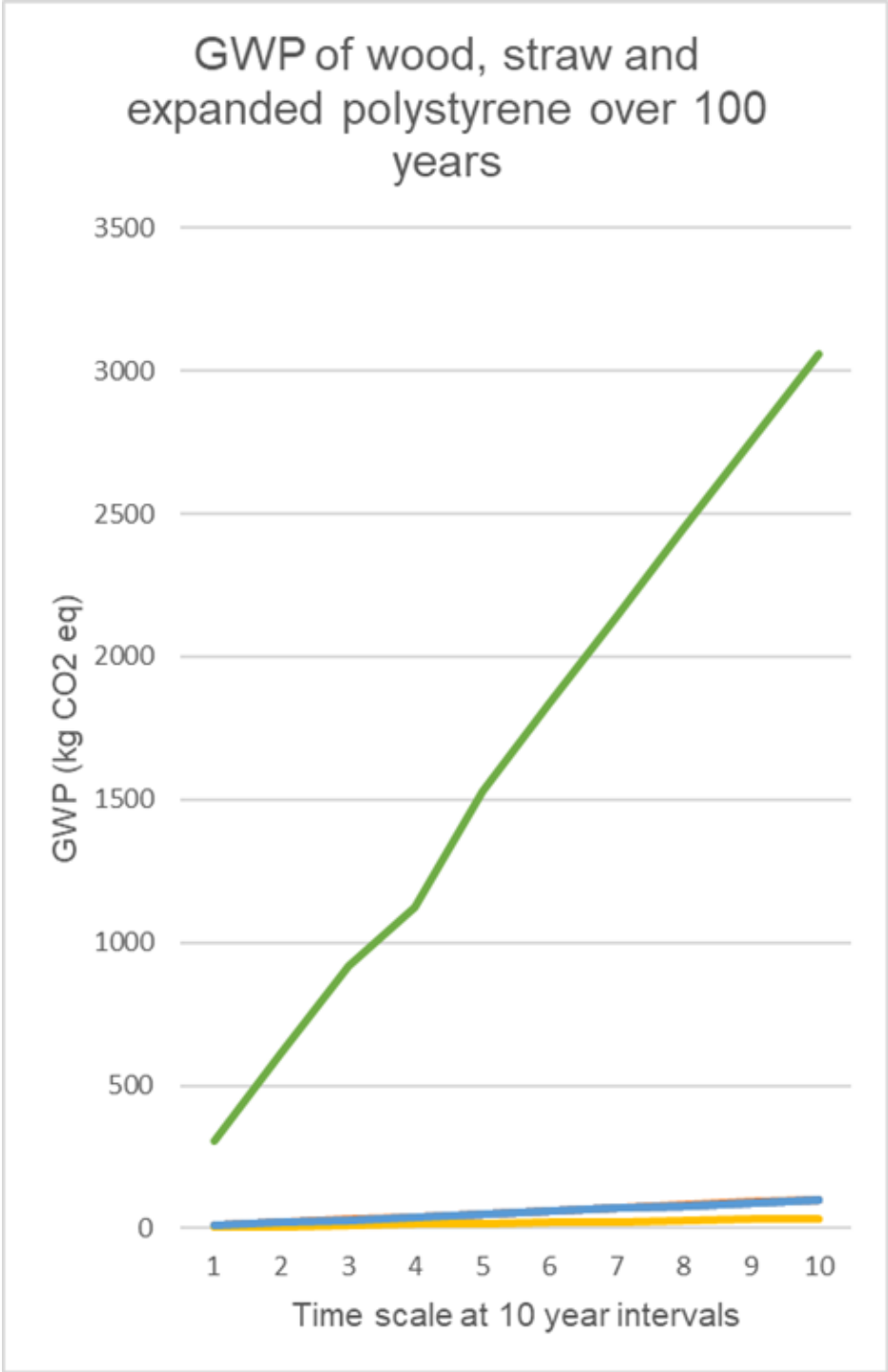


Figure 3. GWP over 100 years.

Conclusion

Natural insulation materials, specifically wood fibre and straw bale, can be effective and sustainable alternatives to conventional materials. Retrofitting all heating oil-fuelled dwellings in the UK with these materials could potentially save nearly £1 billion and significantly reduce the carbon footprint.

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References

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