Environmental Benefits of a Circular Economy: Connecting Waste Type and Geographic Proximity

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Introduction and Methods

The goal of the SHAREBOX project is the development of a platform for the facilitation of circular material and resource flows within the European process industries. The project consortium has 15 partners including research organisations, SMEs and industrial partners as well as market actors and is part of the EU framework program Horizon 2020.

The SHAREBOX platform is a database of available waste and resources required by companies, enabling the transformation of waste to resources by matching of two demands. The key objectives are the facilitation of circular synergies through information and communications technology, the provision of information required to realise circular synergies within European industries and the identification of new circular synergies.

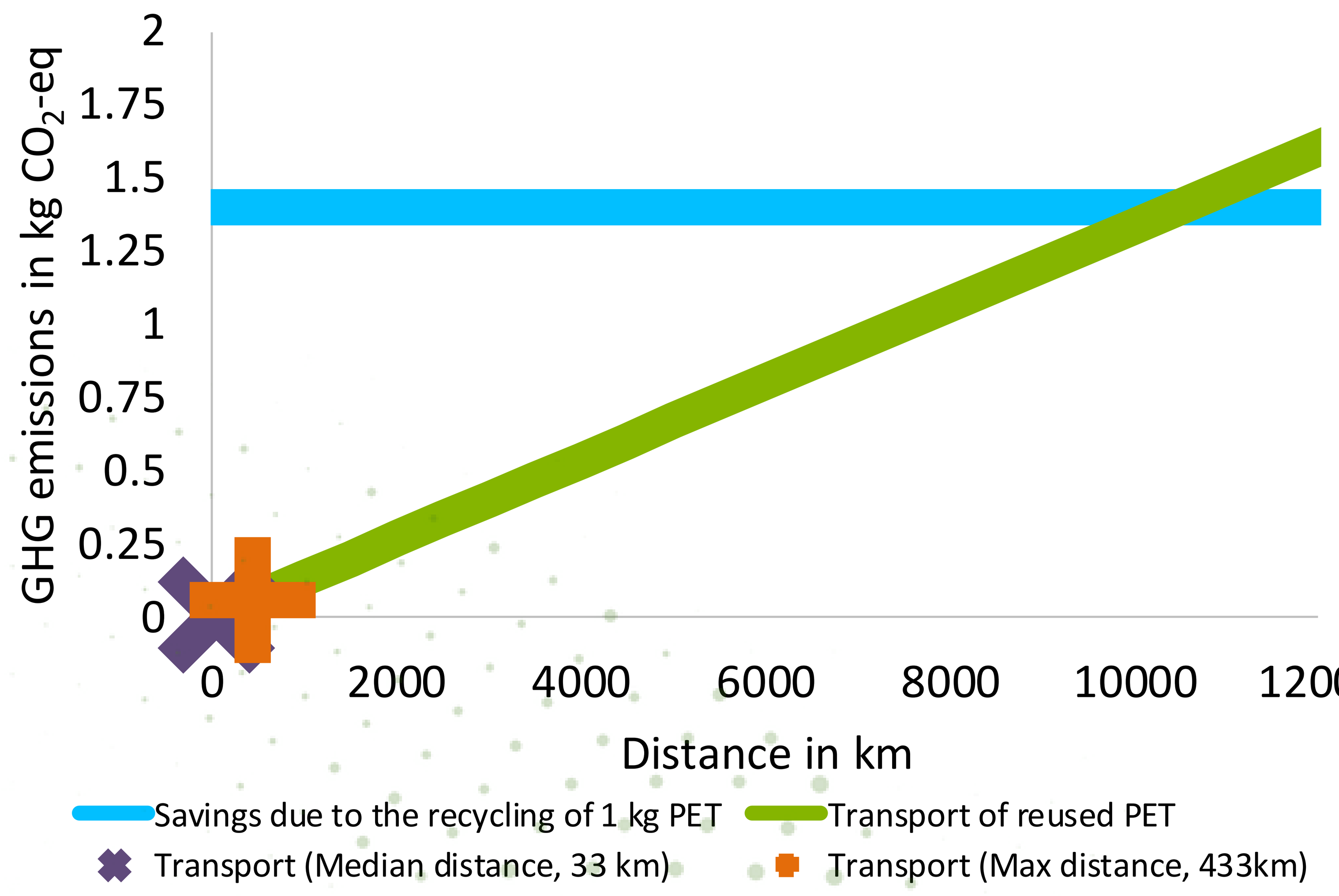


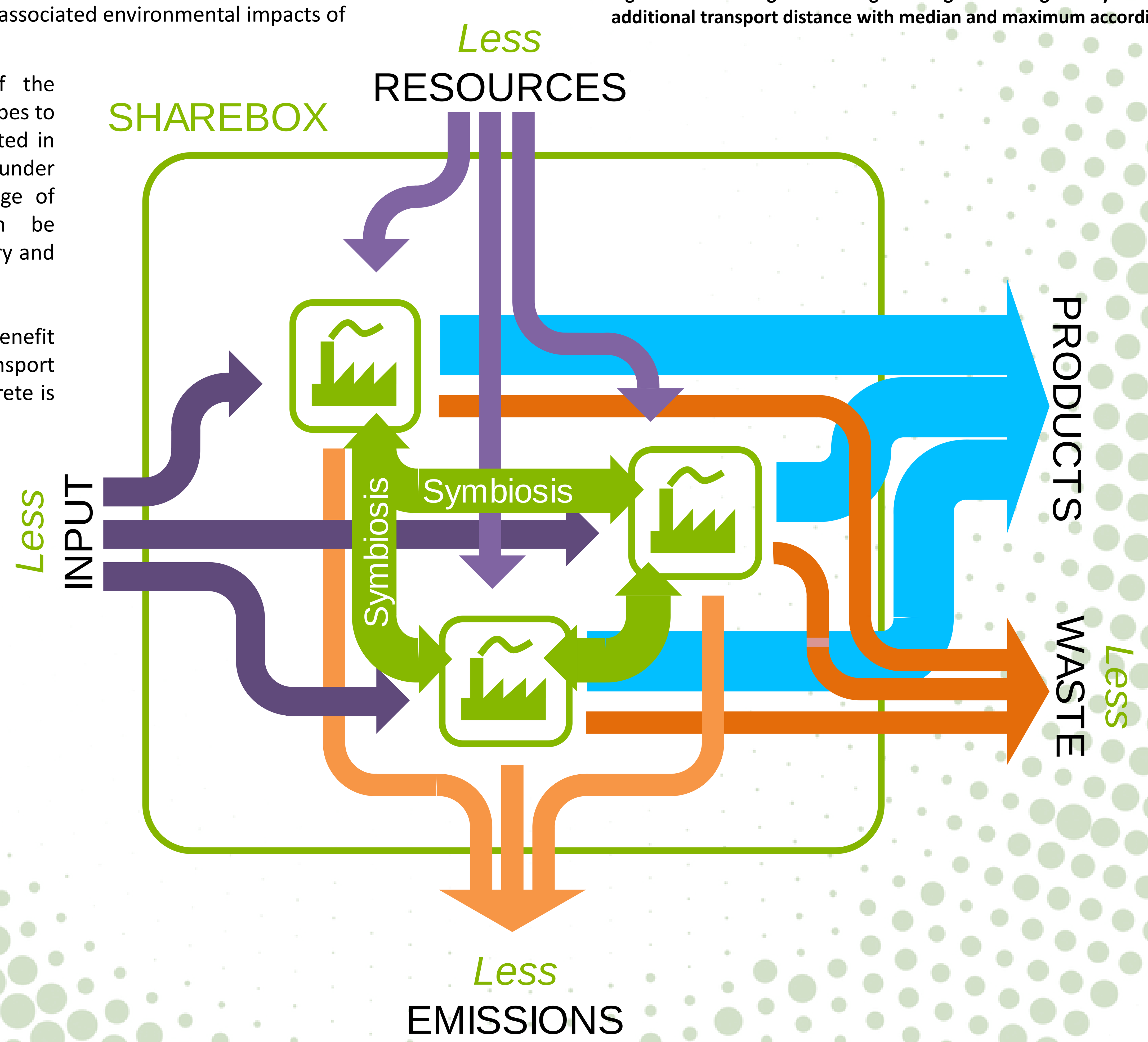
Figure 1: Potential greenhouse gas savings for one kg of recycled PET in kg CO_2-eq compared to additional transport distance with median and maximum according to Jensen et al. [2]

Results and Discussion

The results of circular industry systems facilitated by the National Industrial Symbiosis Program (NISP) in the United Kingdom [1] show a substantial reduction in the consumption of resources and generation of emissions compared to linear systems. Nevertheless, the life cycle stage of transformation also has to be included. A transformation such as the reuse of polyethylene terephthalate (PET) can lead to emissions or require additional auxiliary materials as well as transportation. Therefore, the potential benefit will never be equal to the total impact of the primary input because of the transformation stage and the associated environmental impacts of collection and beneficiation.

We analysed the implications of the Transformation of different waste types to resources when industries are located in different geographic locations under consideration of the life cycle stage of transformation. Waste PET can be transported up to 10 000 km by lorry and still provide a net benefit.

However, in case of concrete a net benefit only occurs if the additional transport distance compared to primary concrete is less than 35 km.



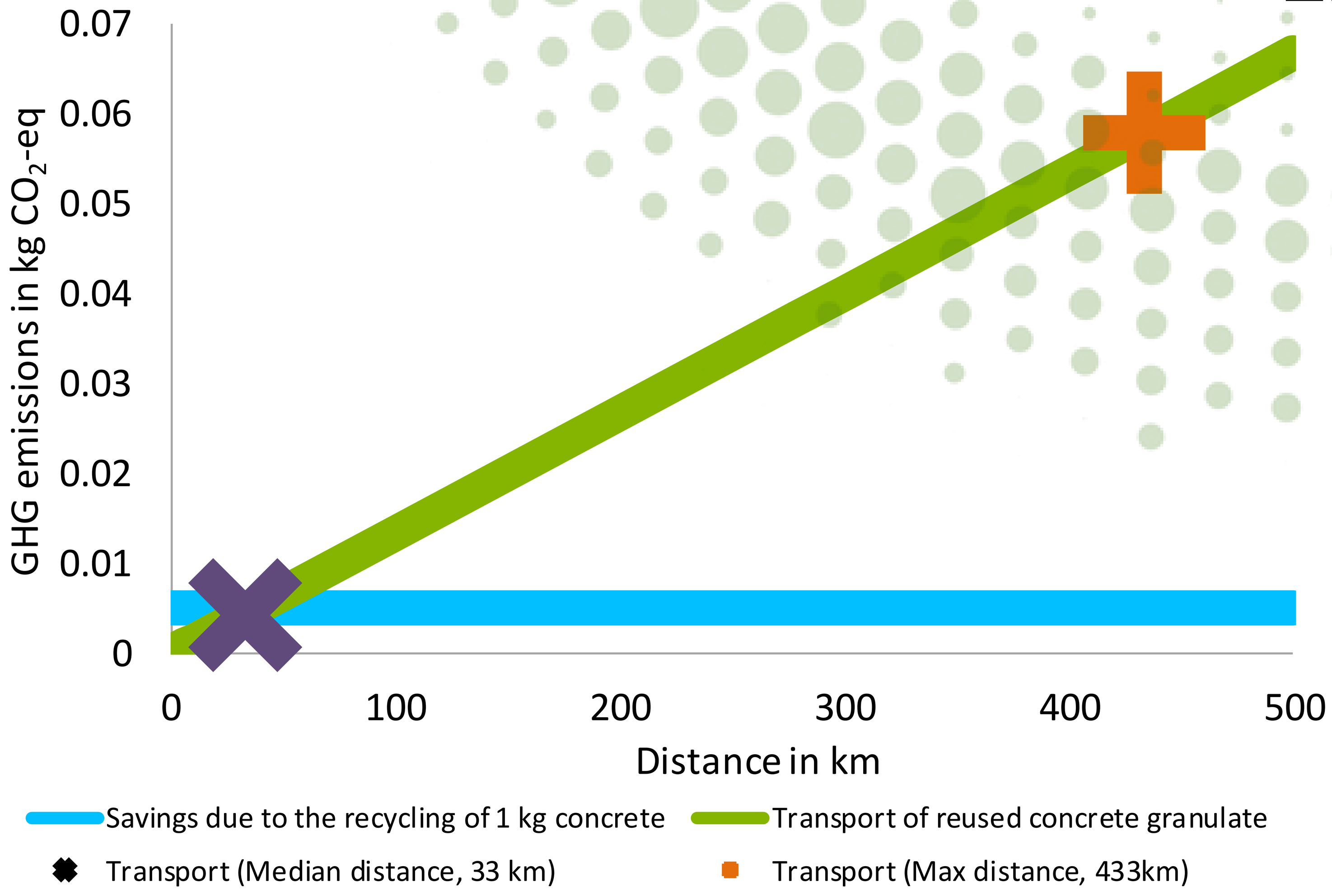


Figure 2: Potential greenhouse gas savings for one kg of recycled concrete in kg CO2-eq compared to additional transport distance with median and maximum according to Jensen et al. [2]

SHAREBOX
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Conclusions

- Transformation from linear to circular systems can substantially reduce total resource consumption as well as emissions of the whole value chain and therefore contribute to a greener economy.
- Matching industries for synergies leading to the substitution of primary materials is still a major challenge.
- The environmental benefits of the reuse of resources is limited by the life cycle stage of the transformation as well as by additional transportation that may be required.
- The analysed set of types of waste shows a broad range of potential benefits. For some types of waste, the net benefits are still considerable after the subtraction of the additional impacts due to the life cycle stage of transformation as well as additional transport requirements.
- The completeness of the scope will be crucial for the assessment and generalisations overarching different types of waste remain challenging.

References and Acknowledgement

1. Laybourn, P. Industrial Symbiosis - Delivering Resource Efficiency and Green Growth 2015.
2. Jensen, P. D.; Basson, L.; Hellawell, E. E.; Bailey, M. R.; Leach, M. Quantifying ‘geographic proximity’: Experiences from the United Kingdom’s National Industrial Symbiosis Programme. Resour. Conserv. Recycl. 2011, 55, 703–712, doi:10.1016/j.resconrec.2011.02.003

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