

Environmental assessment of biofuel production using waste wood integrated in a large-scale steel mill

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Fig. 1: Substitution of powder coal in the blast furnace with torrefied waste wood

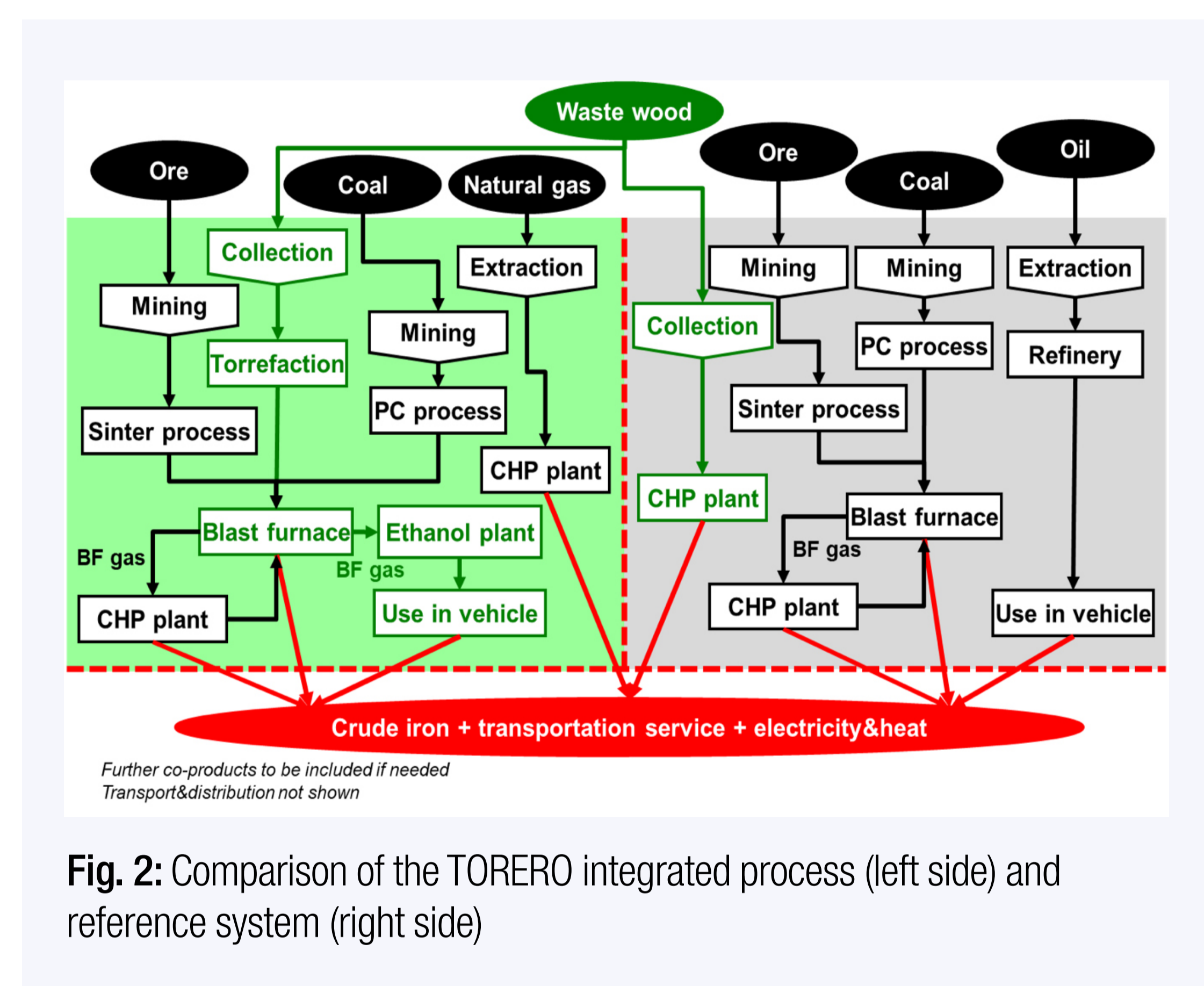


Fig. 2: Comparison of the TORERO integrated process (left side) and reference system (right side)

TORERO demonstration case

TORERO demonstrates the first implementation of a technology concept for creating and using torrefied wood for the production of bio-ethanol, fully integrated in a large-scale, industrially functional steel mill. In TORERO, the wood waste is collected, dried and processed to torrefied biomass. This torrefied biomass is pulverized and used to substitute pulverized coal (PC) in the blast furnace (Fig.1). The blast furnace gas is finally fermented via microbes to bioethanol. The aim is to produce 80 mio. liter of bioethanol per year.

Environmental assessment

To prove the environmental sustainability of this new process a Life Cycle Assessment (LCA) is applied. Therefore, the TORERO results are compared to the results of environmental impacts (e.g. GHG emissions, GHG emission reduction potential, primary energy demand) of a conventional reference system comprising the same product basket as the TORERO integrated process. Fig. 2 shows the necessary steps of the new TORERO integrated process compared with the current reference system. The TORERO integrated process includes waste wood processing (collection and torrefaction of waste wood), crude iron production (mining of ore, sinter plant, pulverized coal (PC) process, blast furnace (BF), and burning of BF gas in a combined heat and power (CHP) plant, and ethanol production (fermentation of the BF gas via microbiological fermentation to

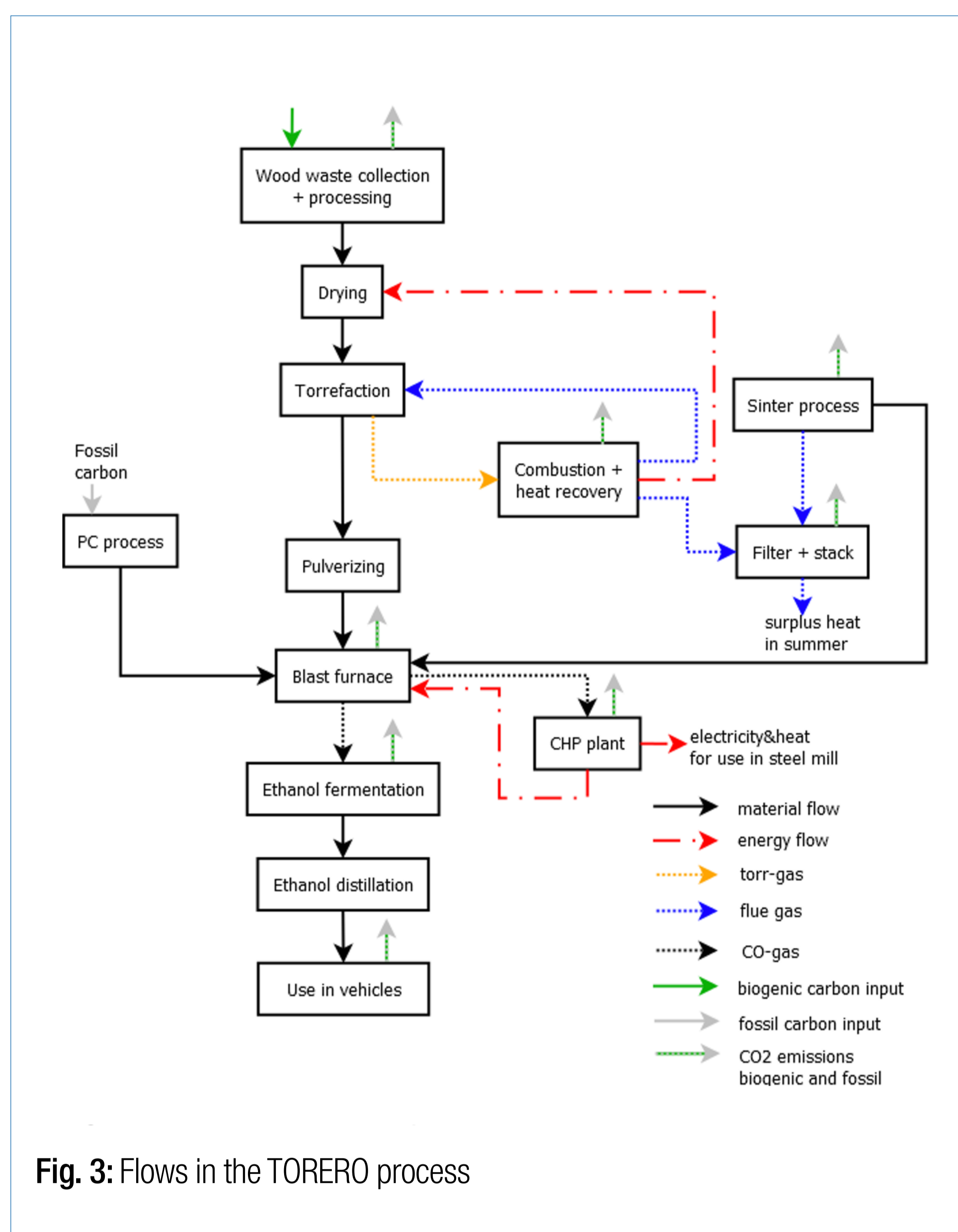


Fig. 3: Flows in the TORERO process

produce ethanol for the use in vehicles). Furthermore, the combustion of natural gas in a CHP plant is included to generate electricity and heat to substitute the electricity and heat generated from waste wood in the conventional reference system.

An important aspect in this LCA is the allocation of biogenic carbon of the waste wood to the different resulting products; Fig. 3 shows material-, energy- and C-flows in the TORERO integrated process. Furthermore, alternative uses of waste wood and the actual situation is included in the assessment.

Conclusion

For assessing this new process chain, it is relevant to consider the following important aspects: including the whole value chain of the waste wood input; the allocation of the biogenic carbon to the different products; avoiding double counting benefit and product use of carbon; distinguishing between the different sources of carbon – fossil and biogenic - for understanding the carbon cycle and effects on global warming; including the current use of waste wood; and comparing the environmental impacts to the actual situation to get a complete picture on the environmental impacts of waste wood use.

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Websites for further information:
<http://www.torero.eu>