

S. GROSLAMBERT¹, V. ERNST² and A. LÉONARD¹

1. University of Liège, Research Unit of Chemical Engineering – PEPs, Belgium
<http://www.chimapp.ulg.ac.be> – s.groslambert@ulg.ac.be

2. Pan – Terre safes - <http://www.grouperterre.be>

Introduction

Buildings notably contribute to global environmental negative impacts due to the consumption of both embodied energy and natural resources, as well as various emissions during their whole life cycle. In this context, the **Life Cycle in Practice (LCiP)** project helps SMEs to reduce the environmental impacts of their products and services across the entire life cycle. Within the frame of this project, **Pan-Terre Acoustix panel** [1] impact is evaluated in a **cradle-to-gate life cycle assessment (LCA)**. Evaluation of environmental performance is needed to support both the design and the production of waste based insulation solutions.

Manufactured for the last twenty past years, the Acoustix Pan-Terre panel is designed for **airborne sound insulation in walls and or floors**. This product can only be obtained by mixing in a sensible way two raw materials from cellulose origin, recycled paper and broken shives of flax. The paper foam reinforced by the linseed wisps provides a rigid panel with exceptional mechanical and acoustic properties.

Materials and Methods

Goal definition

The aim of this study is to assess environmental impacts of sound insulating Pan-terre Acoustix panels.

Scope

The functional unit (FU) is **1 m² (x 16 mm) of Pan-terre Acoustix panel, ready for shipping.**

Methods

- This study is done in accordance with the ISO standards 14040 and 14044 [2].
- CML IA Baseline v3.03 [2] method.
- SimaPro 8.1.0.60 software (PRé-Consultant); Ecoinvent 3.1 database [4].

Inventory and Borders

- 1 panel = 3 m² (1200 x 2500 x 16 mm).
- Process tree is schematized in Figure 1.
- Waste paper is pulped with water, and then mixed with flax shives. The paste is pressed to form panels which are dried in a gas oven. Dried panels are calibrated (thickness) and cut-out (borders) to the right size before being palletized, ready for shipping.
- All the panel waste and the pressing water are recycled in the process.
- Inventory data comes directly from Pan-Terre, except for flax shives (VIBE study in Grow2Build project, literature).
- Lifetime is 100 years (→ CO₂ sequestration in flax is included). Reference year is 2014. Cradle to gate assessment ⇒ no end of life.
- Electricity mix: 74.5% nuclear, 5.5% fossil fuels.

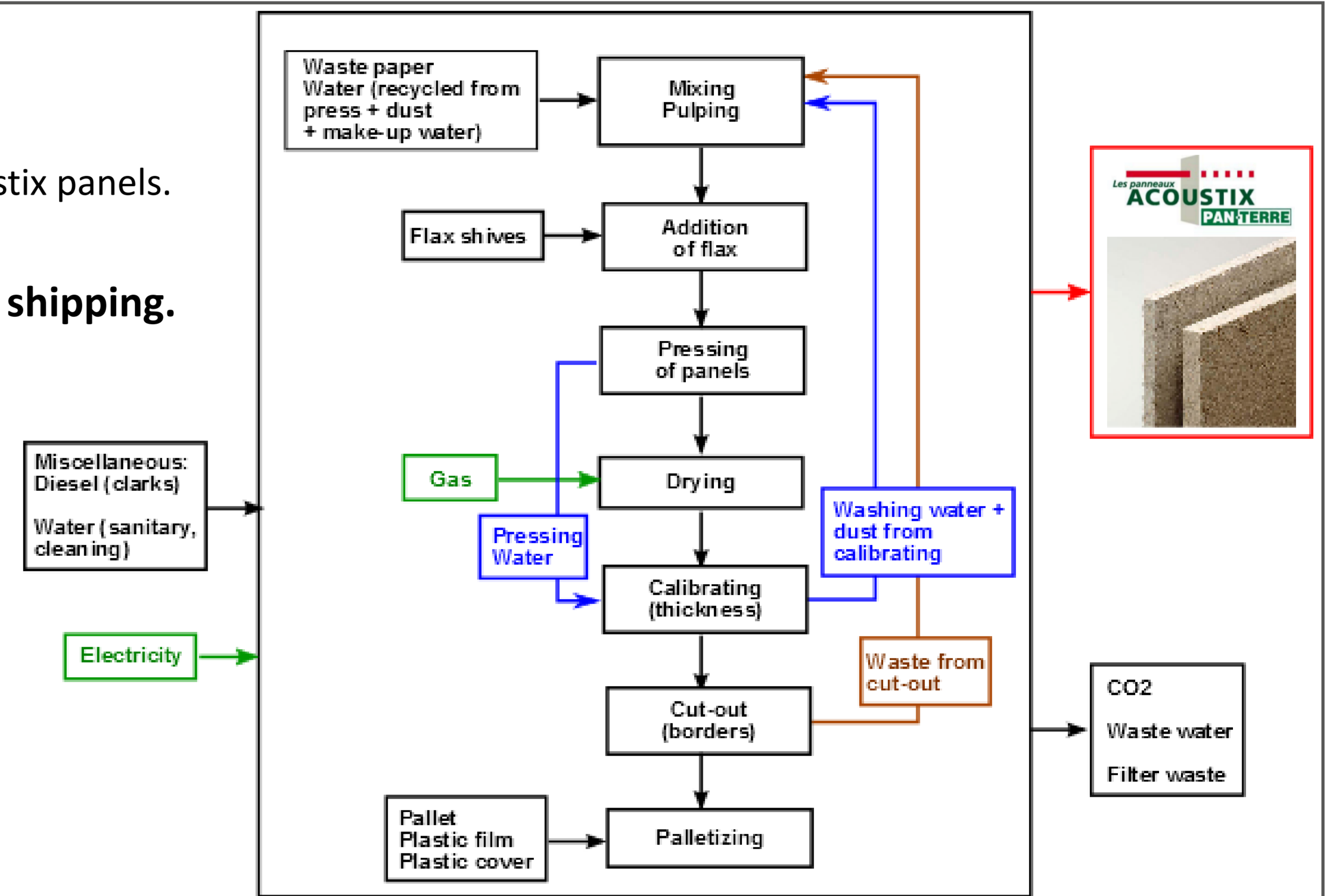


Figure 1. Pan-Terre Acoustix process tree

Results and Discussion

Characterisation main results for 1 FU (incl. lifetime) are presented in Figure 2.

Most impacted categories

- Abiotic depletion (fossil fuels)
- Global warming
- (Abiotic depletion)

Most impacting elements

- **Natural gas (for drying) !!!**
- Electricity
- Environmental benefit: CO₂ sequestration in flax shives



Alternative fuels: textile waste available in Terre and cut-out panel waste (instead of being recycled in process) burned in hot air generator.

- ◆ Panel waste: ~ 6.2% of natural gas consumption
- ◆ Terre collects both textiles and paper waste
- ◆ Ultimate textile waste after valorization and recycling: quantity ok for drying (net calorific value of textiles ≈ 4.5 kWh/kg)
- ◆ NB: new burner(s) and hot air generator are needed (→ € !).

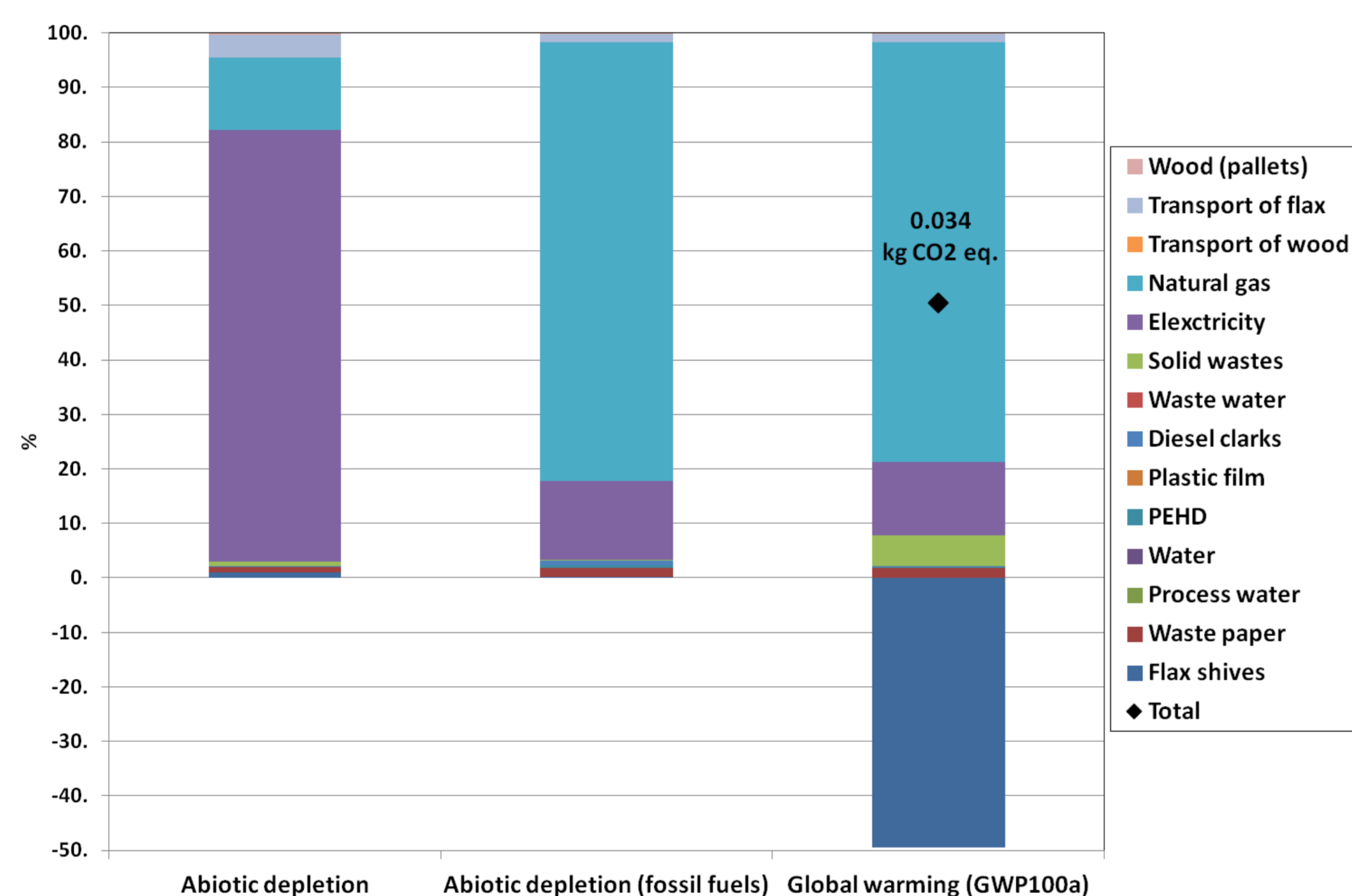


Figure 2: Environmental impacts of 1 UF of Acoustix panel (1 FU)

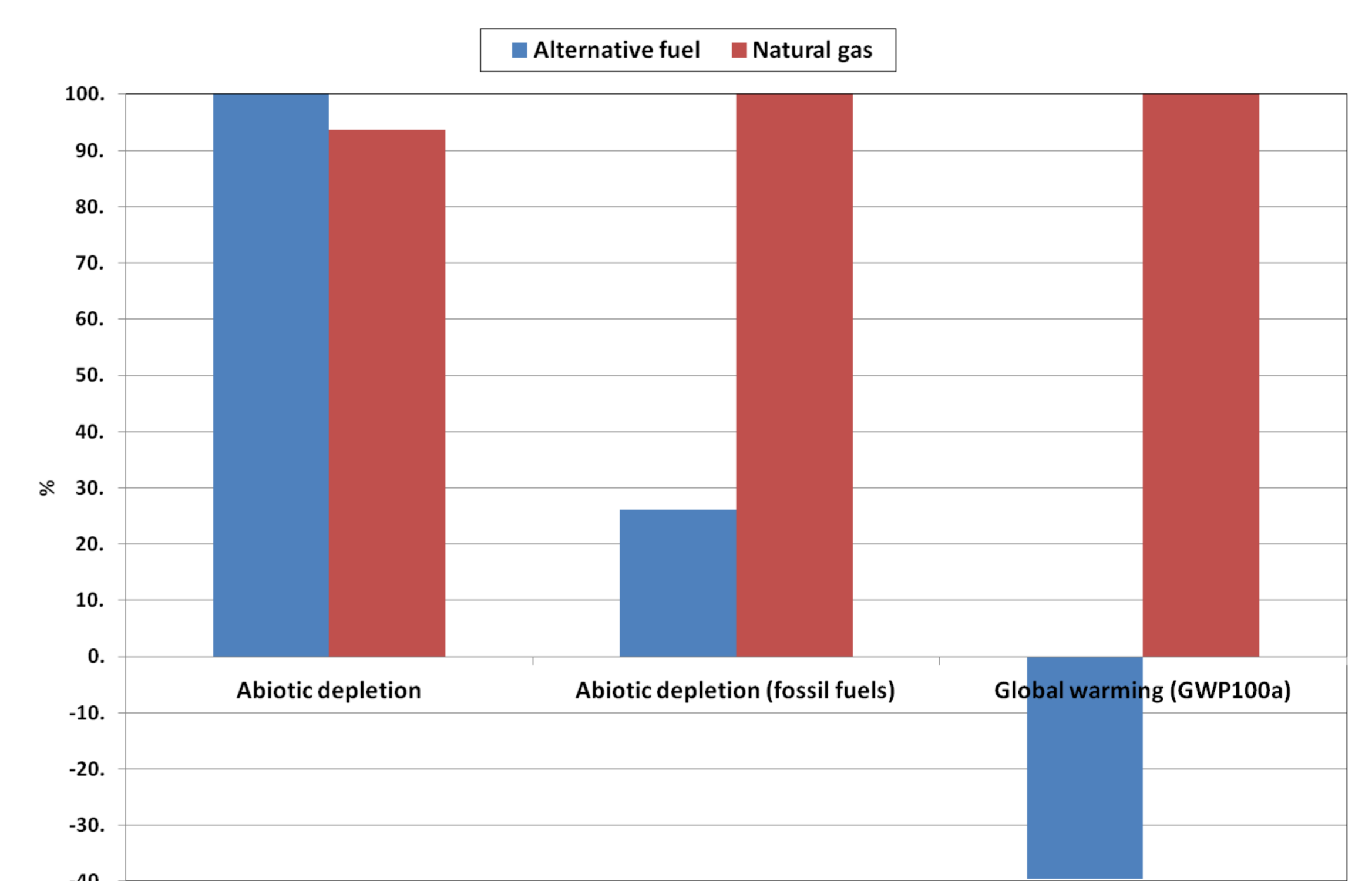


Figure 3: Comparison of impacts of alternative fuel vs natural gas for drying

Conclusions

The life cycle assessment of sound insulation Pan-terre Acoustix panel points up the most impacting elements of the process, which are natural gas and electricity consumptions. The most impacted categories are directly linked to this energy use, i.e. Abiotic depletion (fossil fuel) and Global warming (GWP100a).

Since raw materials are waste (paper) and renewable by-products (flax shives), they have very little impact on the process. Carbon sequestration in flax shives even results in a large environmental benefit for climate change (0.034 kg CO₂ eq instead of 0.066 kg CO₂ eq without carbon capture).

The use of alternative fuel such as panel cut-out and textile waste instead of natural gas for the drying of the panels could drastically reduce the environmental impacts of Pan-Terre Acoustix panels production, especially if a cogeneration unit is implemented. Renewable electricity mix could also help to reduce impact in Fossil fuel depletion and Global warming impact categories. Recovery of drying water could also be considered to save water resources.

LCA of Pan-Terre Acoustix panels process helps to identify potential solutions to assist Pan-Terre in its approach of the improvement of its global environmental impacts.

References
 [1] <http://www.acoustix.be/>
 [2] ISO 14040:2006 Environmental management - Life cycle assessment - Principles and framework; ISO 14044:2006 Environmental management - Life cycle assessment - Requirements and guidelines
 [3] <http://cml.leiden.edu/software/data-cmlia.htm>
 [4] Ecoinvent Centre, The life cycle inventory data version 3.01, 2014. Swiss Center for Life Cycle Inventories. <http://ecoinvent.ch/>