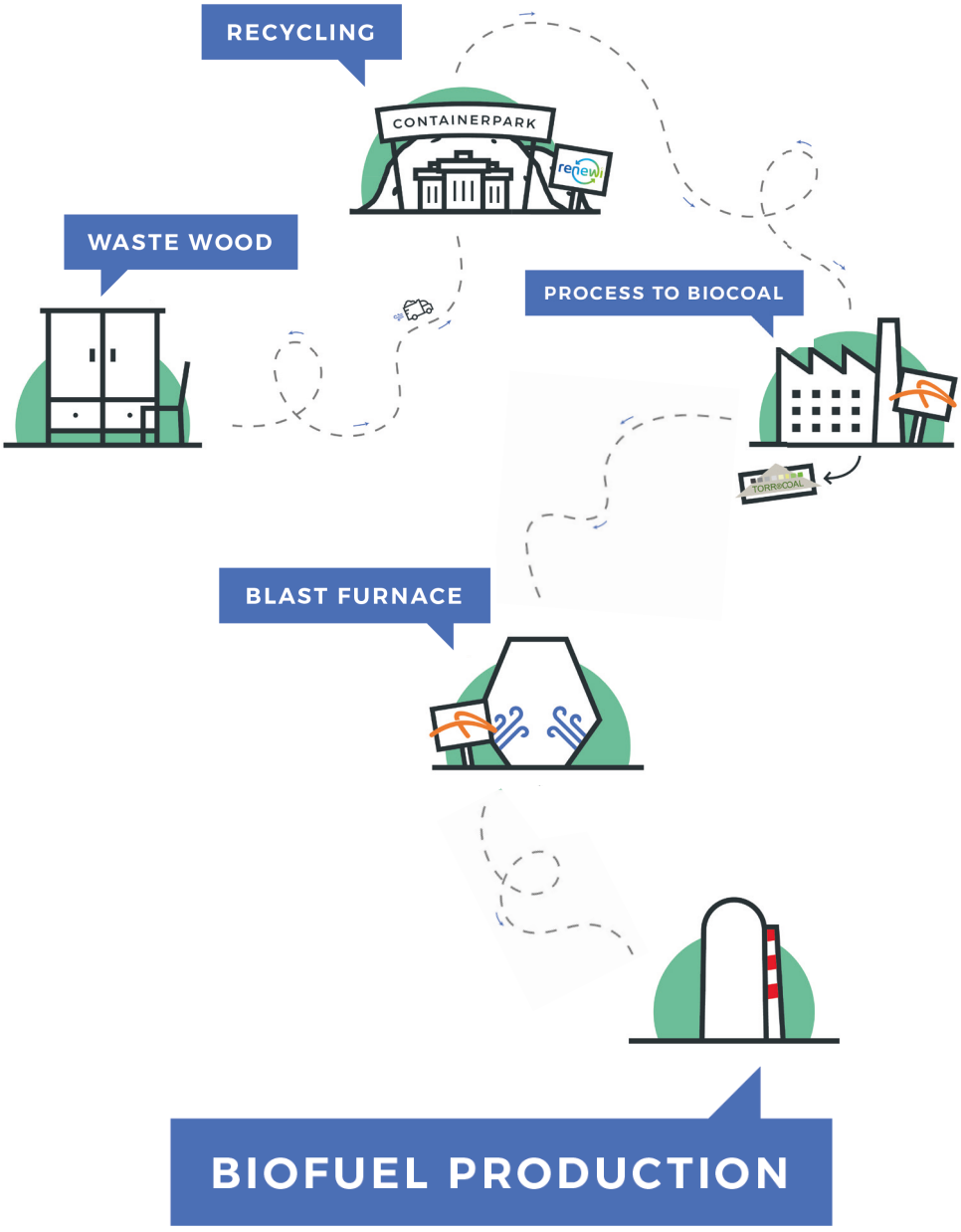
# Torero

Fueling a sustainable future

## TORERO – TORrefying wood with Ethanol as a Renewable Output: large-scale demonstration

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# WASTE WOOD MANAGEMENT, SOURCING, TRANSFER AND MANIPULATION

Wood waste is one of the largest biomass waste streams that is released by companies and households. The properties of wood waste vary considerably, it depends on the origin and method of use. The streams are classified into a number of categories, the Vlarem legislation defines wood waste in (i) **untreated** (ii) **non-contaminated untreated** (iii) **contaminated treated**. On the waste wood markets three different categories, depending on the quality are used: **A, B and C wood**.

| Commercial | Type A-Waste wood | Type B-Waste wood | Type C-Waste wood |
|---|---|---|---|
| VLAREM legislation | Untreated wood | Non-contaminated untreated wood | Contaminated treated wood |
| Hazard status | Not dangerous | Not dangerous | dangerous |

Another differentiation can be done into **"primary"** and **"post-consumer" wood waste**. The first one is produced within the wood processing sector (sawmills, carpentry, joinery, furniture factory etc.). The pure untreated wood waste has a high value, in primary production – mainly in the wood processing industry – it is used for energy valorization in their own heating installation. Untreated wood shavings serve as a raw material in the chipboard industry, for the production of pellets or are sold as litter. Waste from panels or coated wood is used as fuel for incinerations, the fine fraction can be used as solidification of liquid waste. This wood is deposited by collectors and processed together with post-consumer waste.

The latter, "post-consumer" wood waste, is created after households and companies dispose of wooden products and materials at their 'end-of-life'. It usually consists of a heterogeneous mass of different wood qualities. The two most important markets are chipboard industry and energetic valorization. This waste stream is pre-treated at specialized companies to remove impurities before. Chipboard contains about 85% recycled post-consumer wood waste, energetic valorization usually takes place in industrial incineration plants.

## Type A, B, C-Wood

Many more types or qualities of waste wood are distinguished in the market. The distinction between solid B wood and glued / residual B wood is not made in legislation and regulations, but does exist in practice. A recycler usually requires waste wood with a specific specification. This means that the collector and / or the processor ensure a correct mix and reprocessing (breaking, sieving and dusting) so that the demand of the recycler is met.

**To achieve the desired quality**, waste wood collectors and processors therefore make a distinction into the following **categories**:

Figure 1: examples of A-Wood

### A-wood - Untreated wood (not painted, not impregnated, not glued, etc.)

This wood can be released as a mono stream (the wood is kept separate at the source). A-wood as a mono stream is also released by sorting it from a mixture of A and B wood or other mixed waste streams. A-wood has the properties that it is pure (no pollutants and impurities) and dry (in contrast to fresh wood from forests). That is why it is a wanted raw material for the production of objects via the chipboard process, but also for making fuel pellets or broken wood. To burn these clean fuels, a combustion boiler does not have to have additional cleaning techniques for removing contaminants that are present in the wood to be fired.

### B-wood - All waste wood that is not A-wood or C-wood

This wood can also be described as not dangerous treated wood. Solid B-wood, a distinction is often made between solid wood and glued wood. Solid B-wood is unglued wood for which it applies that the amount of paint on a piece of wood is negligible compared to the wood itself. This wood is therefore very useful as a fuel and is also suitable for recycling. After fragmentation, the quality of this wood is almost equivalent to the quality of A-wood. The above does not apply to glued B-wood, such as hardboard, softboard or MDF. The glue is an undesirable contamination of the wood. Glued B-wood can only be part of a new product to a very limited extent. That is why B-wood chips often go to Bio Energy Central (BECs) as a fuel for energy valorization.

Figure 1: Collected Type B-Waste wood ready for further processing and utilization

### C-wood - Wood that has been preserved by adding substances to it that could endanger the environment and human health

Examples for this type of waste wood are e.g. polarized wood (contains heavy metals) and creosote wood (contains tar).

## Markets of Type A, B, C-Wood

The waste wood market can be described as northwest European. Waste wood is both imported and exported.

| Country | Mass (1000t) | | | | |
|---|---|---|---|---|---|
| | Type A and B | Type A | Type B recycable for materials | Type B for energy | Type C |
| Nederlands | 1.367 | 246 | 369 | 752 | 103 |
| Belgium | 919 | 165 | 248 | 506 | 69 |
| Luxembourg | 48 | 9 | 13 | 26 | 4 |
| Germany | 6.448 | 1.161 | 1.741 | 3.546 | 484 |
| Denmark | 448 | 81 | 121 | 247 | 34 |
| Sweden | 797 | 143 | 215 | 438 | 60 |
| Norway | 423 | 76 | 114 | 233 | 32 |
| Finland | 441 | 79 | 119 | 243 | 33 |
| UK | 5.182 | 933 | 1.399 | 2.850 | 389 |
| France | 5.025 | 905 | 1.357 | 2.764 | 377 |

The waste wood market is volatile. Therefore an event in the Netherlands or Belgium can cause a change from surplus to deficit, which is accompanied by large tariff fluctuations. Provided that it is not too abrupt, the waste timber market can properly handle these fluctuations, if necessary, the negative returns from collectors are passed on to disposers. The most important factors that can lead to fluctuations are:

- Expansion of processing capacity (possibly with subsidy for biomass energy)
- Fluctuations in processing capacity due to malfunctions / maintenance
- Changing economic climate
- Seasonal and weather influences
- Innovative buyers
- Changing waste policy in the Netherlands / Belgium or abroad

Figure 2: examples of particle board types

## Products dedicated to end up in Type B –Waste wood

**Particle boards are** manufactured out of particles of wood glued together. These particles are flakes or flakelike forms such as wafers and strands, planer shavings, slivers (or splinters), and fines produced form wood by cutting, breaking or friction. Sources of particles include residues from sawmills and other wood using industries, small-diameter roundwood, defective logs and harvesting residues.

### Veneer

This type of wood is primarily used for plywood and furniture, but are also used in toys, various containers, matches, battery separations and other products.

**Plywood and laminated wood** are both made of layers (laminate) of wood glued together. The basic difference is that in plywood the grain of alternate layers is crossed, in general at right angles, whereas in laminated wood it's done in parallel. The development of these products was possible due to the production of improved adhesives.

Figure 3: example of veneer wood

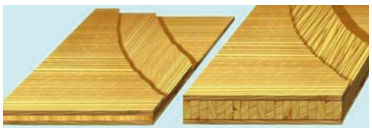

Figure 4: examples of plywood and laminated wood

**Fibre board** is made out of wood fibres. A resin adhesive is not always used in fibreboard manufacture; in some cases the boards are held together by physical forces, the flow of the natural lignin present among the fibres. As in the case of particle board, residues and wood of low quality can be used. Production of fibreboard involves reduction of the wood to particles, pulping, sheet formation, pressing, and finishing treatment.

Figure 5: example of fibre boards

There are two types of fibreboard, i) insulation and ii) compressed (represented mainly by hardboard). The distinction is based on the density and the method of the production.

- Insulation board is used in construction as insulation and cushioning.
- Compressed hardboard has a wide variety of uses, including furniture, house siding, wall paneling, and concrete forms. A relatively new compressed product is medium-density fibreboard (MDF). MDF is manufactured in a range of thicknesses (6–40), usually by the dry process, and it is less dense than hardboard. It can be processed and machined as solid wood and has many uses e.g. furniture, paneling or siding.

### Examples of Type B-Waste wood:

Good examples for products ending up as typical Type B-Waste wood are window frames, doors and frames, kitchen cabinets, furniture, office desks, painted wood, floor and wall panels, pan battens, demolition wood, residues of lumber.

### Actual treatment of Type B-Waste wood

- Collection of the post-consumer wood waste, by container of walking floor transport, released on several treatment sites.
- Presorting by cranes to recover Type A-Waste wood as much as possible out of the Type B-Waste wood stream. Further removing of impurities such as plastics, paper, stones, glass, etc.…
- Pre shredding and iron removal
- Shredding to wood chips (on specification of end-user)
- Fine iron removal, in some cases a non-ferro removal (depends on requirements of end-user)
- Sieving to several fractions
- Transport to end-user, by vessel or road transport

In most cases shredding activities are done by mobile shredding equipment. The volume for the shredding depends on the stock capacity, mobilization costs and outlet possibilities.

On some sites a fix shredding, sorting, removing and sieving machine is installed in line. In that case Renewi prefers to work on a regular way, not in campaigns as with mobile machines. Due to the shredder activities particle boards generate wood dust. This dust problem leads Renewi to take various actions to reduce the nuisance such as using other shredder technics, slower turning, spraying the wood before and during the shredder process, special layout of the site taking account with the wind direction etc. .

## CONSORTIUM

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corporate.arcelormittal.com

**Chalmers University of Technology**
(Sweden)
www.chalmers.se/en

**JOANNEUM RESEARCH**
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www.joanneum.at/en/life

**TORR®COAL**
(The Netherlands)
www.torrcoal.com/en

**Renewi**
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