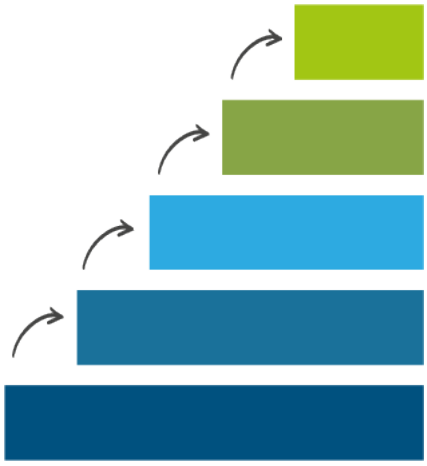
BALTIC INDUSTRIAL SYMBIOSIS

Generic case

# SYMBIOSES WITH WOOD RESIDUALS



SYMBIOSIS CENTER DENMARK
DANSK SYMBIOSECENTER

interreg
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## THE MAIN POINTS

Symbiosis with residual wood creates both economic and environmental benefits. Combustion, as an alternative to recycling is both costly and does not utilize the resource potentials of wood optimally.

Large amounts of residual wood can usually be found in the following industries: loggers, carpenters, carpentry firms, sawmills, agriculture and contractors performing new construction and renovation, as well as manufacturers of furniture, floors and windows, among others. There are significant amounts of residual wood in households, such as discarded furniture.

There are great potentials for utilization of residual wood for reuse or recycling, thus creating economic and environmental benefits.

## UTILIZATION

There are a wide variety of utilization purposes for wood residuals. Particularly, there are many opportunities for recycling and upcycling/reuse of wood residues in new furniture and building materials.
The residual wood can be used as raw material for other industries or for energy production.

However, utilization depends particularly on whether the wood contains nails, chemical additives, has been painted, impregnated or the like.

## GREAT SAVINGS AND ENVIRONMENTAL BENEFITS

Symbioses based on residual wood utilization can create economic savings for companies wishing to receive or sell wood residue resources, while contributing to significant environmental benefits.

The financial gain typically occurs by the fact that residual wood replaces a purchase of wood at a wood manufacturing company. The company thereby reduces the cost of purchasing raw materials, while the selling company can achieve a financial gain by reducing costs associated with disposal of residual wood.waste product. Such symbiosis cooperation is also advantageous for the bottom line; it strengthens competitiveness, reduces operating costs, and contributes to environmental gain.

## WOOD RESIDUES

Wood residues can be found in many industries and in different quality categories, for example, companies that deal directly with wood, such as carpentry and floor manufacturers, as well as contractors, demolition companies and households.

The wood residues can occur as untreated wood or can be painted, lacquered, impregnated, treated with fungicide, contain residues of glue etc. All types of residual wood may contain nails, screws or the like.

Untreated wood residues can include:

- Wooden pallets
- Offcuts from carpentry work
- Packaging boxes
- Residues from joinery work

The widespread wood residuals come from the fact that many companies use pallets, disposable pallets and wood packaging boxes in their daily production and distribution. This wood is usually untreated and can be recycled in several different ways depending on its condition. In addition, there are large amounts of sawdust, bark, wood chips and shavings at sawmills, furniture manufacturers and others, which appear as byproducts from mechanical woodworking processes. These wood residues also constitute a pure resource stream and are often used as raw material to produce wood pellets and particle boards.

Wood residues that are painted or surface treated can be:

- Plywood
- Painted doors, window frames and panel products
- Roof timber
- Furniture

These residues can be found mainly in new construction, demolition and renovation and can often be reused directly for the same purpose or reused for new production of furniture, building materials or other wood products. The possibilities depend on quality and purity of the wood. However, in some cases application options can be limited, especially if the residual wood is treated with wood preserving chemicals or impregnation, which can often contain high amounts of harmful substances such as lead, arsenic and creosote. In this case, it is classified as hazardous waste and must be deposited or incinerated at special plants.

### DIRECT RECYCLING

Some discarded wood waste is suitable for utilization directly for the same or other purposes. Direct recycling is the most optimal utilization opportunity and is located at the top of the waste hierarchy, as it means that no energy is used to process the material before recycling. It is often the case for discarded furniture and building waste, which is often beneficial to other users for the same purpose. In addition, there are large amounts of crude (raw) wood, which can be directly recycled for other purposes that do not require processing.

### PROCESSING

One way of recycling is to reshape wood residuals, for example by gluing them together into larger pieces, after which the wood can fulfill a new function. The new piece of wood can be a part of a piece of furniture, e.g. a tabletop, shelves, table legs or the like. For example, wood fractions can be renovated and reused to build new pieces of furniture. Large amounts of residual wood can also be recycled to produce chipboard products. Chipboard companies receive, sort and clean residual wood from companies working with wood and recycling stations. The result is a uniform sheet product consisting of 60-70% residual wood with many different applications. A large proportion of the residual wood used for chipboard pro-

duction is a byproduct from the wood industry, such as wood shavings, wood chips and cut residual wood from e.g. discarded furniture. However, chipboard manufacturers are rarely interested in smaller amounts of residual wood. Therefore, it requires that a company that plans to sell residual wood for chipboard production has very large quantities of wood available or there is a third party that gathers residual wood from several companies before large enough quantities are found.

## PRODUCTION OF WOOD PELLETS

Wood is an important energy resource in the transition to a fossil-free energy sector, and therefore, residual wood can be used for producing wood pellets, if no other recycling is possible. Wood pellets are made by compressing residual wood. As renewable fuel, wood pellets can replace coal and gas at power stations. Wood pellets are made of dry wood residues such as sawdust and shavings.

## BIOREFINERY

New technologies in biomass utilization are in rapid development. In the future, residual wood can potentially become a raw material in bio refineries, where both valuable chemicals, raw materials and various fuels are extracted. In this way, a very valuable resource can be obtained, which can replace transport fuel based on fossil fuels.

### SYMBIOSIS EXAMPLE - RENOSYD

RenoSyd I/S became aware of the possibility for increasing the quality of recycling of windows and doors, by direct utilization of these building materials in renovations, buildings or for other purposes, e.g. greenhouses and hotbeds. Therefore, RenoSyd I/S together with GENBYG.dk A/S has established a symbiosis that deals with direct recycling of doors and windows.

RenoSyd I/S is Denmark's only "Value Company" that receives waste from private and businesses and transforms it into values through direct recycling. Doors and windows received by RenoSyd I/S will then be sold at GENBYG.dk A/S, which is Denmark's largest online store that sells used building materials.

The windows were previously sold to waste company P. Fournaise, which recycles glass and metal parts. The remaining materials, mainly wooden frames, are utilized as a source of energy by incineration at waste incineration plants or at NORD A/S depending on whether content of polychlorinated biphenyl (PCB) has been identified in the window frames during processing.

## ECONOMIC PROFIT

Residual wood can, with economic benefits, be reused in new materials or as fuel in energy production. The savings in wood symbiosis depend on several conditions such as purity and quality of wood residues, security of supply, transport distances, etc. By receiving residual wood that serves as raw material input, a company can achieve savings by reducing the amount of virgin materials. Companies that sell residual wood save on disposal costs and get new sources of revenue from the sale of recycled wood.

Sorting of wood residues typically increase the financial gain for companies, as wood has a higher value and recycling potential in cleaner/purer form. It can reduce or eliminate the cost of incineration or landfill of residual wood that costs between EUR 64 - 120 per ton, depending on purity and disposal methods. When sorting residual wood, costs are also reduced by limiting the number of tests on the content of hazardous substances in wood, and segregated materials can be sent to the correct processing.

By establishing a local industrial symbiosis, transport costs can be minimized, which also reduces the disposal costs. It can be particularly advantageous if the purity of residual wood is not high and the fraction itself does not have a particularly high economic value.

By utilizing residual wood, companies can also get a stronger green profile and a stronger competitiveness.

### SYMBIOSIS EXAMPLE - ECONOMIC PROFIT IN SYMBIOSIS WITH GLOBAL BYGGESERVICE

If the symbiosis between the four companies is established, Holbæk Affald A/S will achieve annual savings of up to EUR 27 per ton by reducing disposal costs on pressure-impregnated wood, while the other companies will get new sources of income and save on reduced material costs. The symbiosis can create new jobs at both Global Byggeservice ApS, Danalim A/S and Johannes Fog A/S. In addition, all four companies will achieve increased competitiveness as the symbiosis will be the only place in Denmark where pressure-impregnated wood is recycled.

### SYMBIOSIS EXAMPLE - ECONOMIC PROFIT IN SYMBIOSIS WITH RENOSYD

RenoSyd I/S profits from the sale of doors and windows to GENBYG A/S. By direct recycling, when the windows and doors are sold to GENBYG.DK A/S, treatment costs can be saved considerably. The savings can be maximized if quality, appearance etc. of wood is at its peak. GENBYG A/S pays EUR 7 per. window/door and makes profit by selling them.

## ENVIRONMENTAL VALUE

When using wood residues, great environmental benefits can be achieved.

Recycling contributes to cost savings on virgin materials, thus saving natural resources. Moreover, it reduces energy consumption for production of new materials, thereby avoiding an additional environmental impact.

Environmental benefits are also achieved if residual wood is utilized rather than deposited, since landfill and incineration only partially or not at all utilize properties of wood. An additional environmental benefit will also occur if wood fractions are utilized as locally as possible, as transport requirement is thereby reduced, which also leads to reduction of combustion of fossil fuels and its accompanying emissions of e.g. greenhouse gases and particles.

Overall, it is estimated that this symbiosis can achieve CO2 reduction of between 44 and 60 tons of CO2 annually, which is expected to increase sharply as large quantities of impregnated wood are utilized. Besides CO2 reduction, there are other environmental benefits. For example, the amount of chromium, copper and tin supplied to incineration plants is reduced by reusing impregnated residual wood.

### SYMBIOSIS EXAMPLE - ENVIRONMENTAL PROFIT IN SYMBIOSIS WITH RENOSYD

The environmental benefit has a great influence on the establishment of the symbiosis. By direct reusing of doors and windows, the environmental impact is reduced. Reduction in the consumption of virgin materials and combustion results in a significant reduction in CO2 emissions. According to life cycle impact data, it is approx. 2 kg CO2 per m2 of a window.

### SYMBIOSIS EXAMPLE - ENVIRONMENTAL PROFIT IN SYMBIOSIS WITH GLOBAL BYGGESERVICE

The Symbiosis in Holbæk results in great environmental benefits. By replacing new wood with impregnated wood, the consumption of virgin wood and energy is reduced in the manufacturing process.

A significant annual reduction in CO2 emissions is also achieved by avoiding a new impregnation process. In addition, there will be a further reduction in greenhouse gas emissions through local handling of the impregnated wood, as it is normally transported to Germany for incineration.

## BARRIERS

There are different technical and regulatory barriers, that should be addressed, because establishment of a symbiosis with wood gives the greatest possible value for the partners involved.

Examples of these barriers are:

### REMNANTS OF NAILS, SCREWS, etc.

Many companies' residual wood contains fittings, nails and screws, which can be a barrier to recycling. However, most recycling companies accept smaller items of metal such as nails, screws and brackets, as they are removed during processing before recycling.

### PRESSURE IMPREGNATION, PAINTING AND SURFACE TREATMENT

If wood is impregnated with arsenic, lead and creosote, it should not be used in new products for health reasons. It is a challenge if these two types of wood are mixed with the rest of the wood, as it makes recycling difficult, and they are considered as hazardous waste. The company's ability to sell wood can be significantly increased by sorting the wood so that pressure-impregnated, painted and surface-treated residual wood is sorted out from the other clean wood residues.

### LOW PRICE OF WOOD, WOOD RESIDUES, SHAVINGS AND CHIPS

The relatively low price of many types of residual wood can make it difficult to find a profitable symbiosis. Typically, either large amounts of wood are required to offset transport costs, or the residual wood should be utilized locally, to minimize transportation.

This case reviews symbiosis possibilities for wood and aims to inspire with better utilization of this residual by describing options and benefits of such symbiosis. Please do not use the case as a design or decision basis.

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