SUSTAINABILITY

SOLID TIMBER MANUAL 2.0

binderholz

Rigips
SAINT-GOBAIN

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Binderholz GmbH and Saint-Gobain Rigips Austria GesmbH

Technical implementation
Dipl.-Ing. (FH) Tim Sleik, Dipl.-Ing. Christian Kolbitsch and
Dipl.-Ing. (FH) Jens Koch

Graphic implementation
Advertising Agency Goldfeder – Jasmin Brunner

Photos
binderholz, Rigips Austria, b&k structures, www.christof-reich.com,
Daniel Shearing

HOTLINES:

Binderholz Bausysteme GmbH
Tel. +43 6245 70500
www.binderholz.com

Saint-Gobain Rigips Austria GesmbH
Tel. +43 1 616 29 80-517
www.rigips.com

CONTENTS

SUSTAINABILITY

Future challenges

With 17 defined goals, the so-called Sustainable Development Goals (SDGs), UNECE lists its milestones for a sustainable further development. These are to contribute to mastering the global ecological, economic and social challenges (see Figure 1). To support reaching these goals, a campaign of measures has been launched. It is a special initiative of the UN Secretary General that is managed by the United Nations development programme. It is supported by the United Nations and the Member States in the publication and involvement of the public in the implementation of the SDGs. The SDGs apply to all states, companies and civil societies and took force on 1 January 2016 with a term of 15 years.

Figure 1 – 17 SDGs of the UNECE

Paris Agreement

In contrast to the Kyoto Protocol of the year 1997, the Paris Agreement obligates all states without exception for the first time since 2015 to develop a national climate protection contribution ("nationally determined contribution", NDC). Each state must resolve measures for implementation and also fulfil these. The primary goal is the so-called 2-degree target: By 2015, the global emissions are to be reduced by 40% to 70%, so that the critical temperature increase of 2 degrees Celsius is not exceeded. Furthermore, new comprehensive rules on the protection of forests have been adopted. New forms for the international cooperation on carbon markets are being established and the states are called upon to respond better to climate change and arrange global financial flows in such a way that climate protection is in the foreground.

Saint-Gobain contributes actively in the implementation of the Agreement and is available actively with its competence also at advanced conferences and to interested groups.

Moreover, the Paris Agreement can already accelerate reaching the goals by targeted specific measures such as the consistent use of wood in the construction sector.

Wood – THE most sustainable raw and building material

Following the principle of consuming only as much in the presence so that more will be available in the future, sustainability is and stays the top priority in European forestry. Accordingly, the three basic functions of the forest (utility, protection, and recreation function) is to be and remain available also for next generations. About 300 years ago, the term sustainability was coined by Hans Carl von Carlowitz in his "Silvicultura oeconomica". This economic management concept that was originally developed exclusively for forestry is put into practice today more than ever and in politics and the economy it by now stands for the model of a future-oriented use of resources worldwide. This is also reflected in the official data of the EU. Accordingly, the forested area in the EU has increased by 2% in 15 years, which means an absolute growth of rounded 4 million hectares of forested area. The same applies to the forestry and use of timber from the forests at a national level.

In Austria, currently nearly half of the country's entire territory is forest (see Figure 2). Since 1961, an area of 300,000 hectares has been added and by now, 0.5 hectares of forest per resident is reached. Of this, 82% is in private and 18% in public ownership. As continuously more timber regrows than is harvested, the Austrian forest, differently than is the case in the clearing of tropical forests, can perpetually spread more. Moreover, Austrian forests are the home to 3.4 billion trees and 65 different types of trees with a total reservoir of 1.1 billion metres of existing forest. Of the 30.4 million solid cubic metres that regrow each year in the Austrian forests, 25.9 million solid cubic metres are extracted to fully satisfy the principle of sustainable forestry.

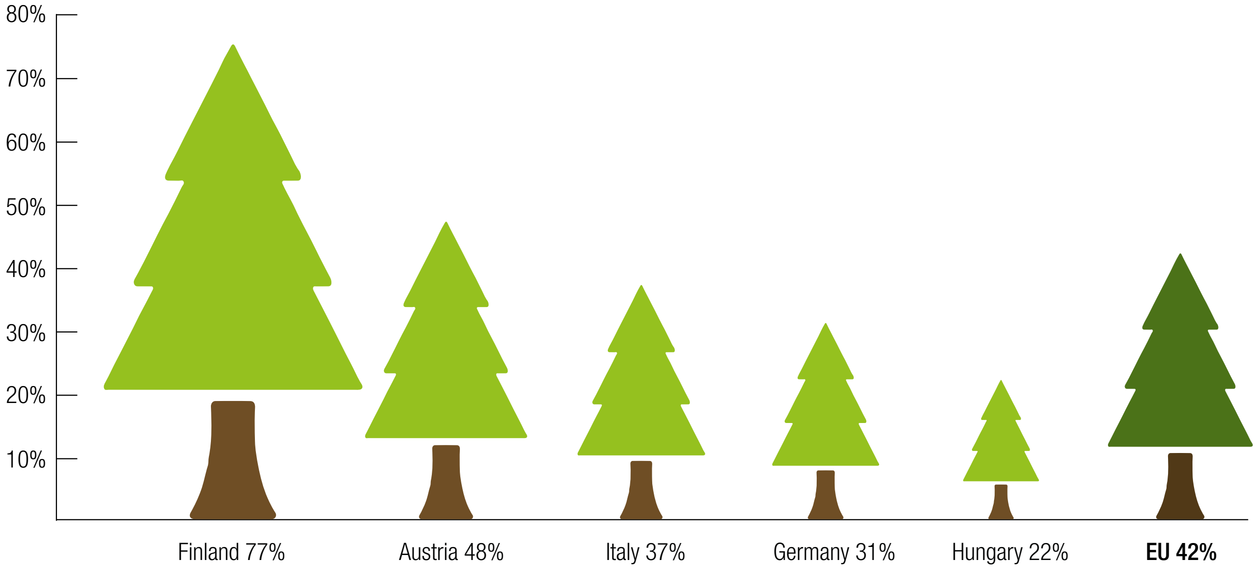

Figure 2 – Forest area of the EU Member States, Zuschnitt 51 proholz Austria

In contrast to the tropical rainforest, Austria's forest may not serve as a so-called "rainmaker" but it ensures that the country stays fresh and moist. The relative humidity in the forest is up to 10% higher than in the surrounding land. It thereby regulates the climatic conditions, binds greenhouse gases, protects against avalanches and flood water, promotes biodiversity and additionally serves as a local recreation area. In addition, it makes a significant contribution to the drinking water in the country maintaining its high quality.

Germany is among the European countries with the largest forested areas. Overall, there are about 90 billion trees in Germany's forests. One-third of the country's entire territory is covered by forests – this equals 11.4 billion hectares. In spite of its low growth of 0.4%, the forest keeps growing further. The Federal States that have the most forest in terms of hectares are Hesse and Rhineland-Palatinate with 42%.

Source: The forest in Germany

The German forest is characterised by its great biodiversity with 90 species of trees, 1,215 species of plants and 6,700 animal species. Without overextending the use of the forest, up to 120 million m³ of timber can be harvested in the domestic territory per year. As the annual timber consumption of Germany is around 135 million m³, 11% of the consumed timber must be imported. The annual timber increase according to the third Federal Forest Inventory is 121.6 m³ of timber. This equals forty times the Giza Pyramid in comparison. Thus, a converted 3.8 m³ of wood regrows per second in the German forest. The overall inventory of timer available in the German forest is 3.7 billion m³. Thus, Germany has the highest timber inventory in Europe.

Source: Timber Balance for Germany

In Finland, 77% of the country's total territory is covered by forest, which means 4.2 hectares wooden area per resident. Nearly half of the Finish forests are pinewoods, the largest remaining portion is split between spruce, downy birch and weeping birch. The majority of Finland's forests are mixed forests, thus they are home to more than one species. Overall 30 different domestic species can be found in Finland.

The Finish forestry as well is managed according to the principle of sustainability because the annual increase of forests by 30% exceeds the annual timber harvest quantities. Consequently, the Finish forest grows continuously and this is true for all tree species and forest areas of Finland. The annual growth has exceeded the 100-million cubic metre threshold since a few years ago. In the year 2014, for example, there was a growth of 104 million m³. The total volume of the Finish forest in 2014 was at 2,360 billion m³ and since the beginning of the 21st century, Finland's timber inventories have grown by 60%.

Source: Finland's forests

Guaranteed sustainability along the supply chain – Chain of Custody (CoC)

To guarantee the benefits of the sustainable and resource-conscious European forestry for the end user along the entire value added chain, consistent monitoring along the supply and production chain is needed – from the tree to the customer!

At the level of the EU Member States, country-specific forestry laws ensure compliance with a sustainable and adjusted forestry. In the international economic area, this is ensured through a legal framework of the European Union to facilitate consistent control and monitoring of the sustainable supply chain.

The FLEGT action plan and the EUTR

With the FLEGT actions plan (Forest Law Enforcement, Governance and Trade), the EU has adopted a broadly based catalogue of measures to effectively fight the global problem of uncontrolled and illegal wood harvest. An important point in the FLEGT actions plan meanwhile is the European Timber Regulation (EUTR). At its core, it demands from all European market actors that they are accountable in the worldwide procurement of wood and wood products, to thereby be able to build up a sustainable supply chain in the long term.

The regulation, which took force on 3 March 2013, foremost demands central proof that illegal sources of timber are excluded by companies importing to the European Union. For this purpose, each importer has to undergo a company-internal due diligence process, which is based on three central pillars:

- Procurement of information
- Risk assessment
- Risk reduction

Source: FLEGT approval system

Independent certification of the supply chain

Besides the strict public control bodies, the companies of the timber industry can seek additional testing from independent certifying institutions. Various service providers such as the PEFC or FSC are available for this.

PEFC is the largest institution for the assurance and marketing of sustainable forestry by means of an independent certification system. It ensures a sustainable, careful and responsible forestry. This way, our forests will stay preserved also for future generations – as a living basis, workplace and recreational area. The aim is to continuously improve our forestry, preserve the forest and assure its positive effects on the environment. Thanks to an accreditation procedure according to international standards, the independence of the certifying institutes is guaranteed to a particularly high measure. The emphases here are on facilitating the fair participation of all forest owners, regardless of the size of their business, and consideration for the diversity of forest ecosystems, cultural heritage and ownership structures. PEFC is the first system that has integrated social criteria not only in the forest certification but also in the product chain certification (Chain of Custody).

Certification by binderholz

PEFC/06-35-20

The traceability of the origin of the wood and the exclusion of exploitative harvesting represent the basis for certification and guarantee this way the promotion of a socially and environmentally compatible economy. The diversity of plants and animals thereby remains preserved and the social interests of humans are taken into consideration. As processing companies are also certified, the certification status is maintained up to the end customer.

Forest owners cannot only have their forests certified directly by a certifying institute but the buyers of the logs, in cooperation with the forest owners, can additionally rate wood originating from non-certified forests by means of a specially developed due diligence system, which has been accredited in advance by a certifying institute, and they can exclude it from the further process in the case of uncertainties.

All products of binderholz are 100% PEFC-certified or made of wood that originates from PEFC-controlled sources. The implementation of the strict PEFC criteria and a permanent internal self-monitoring of the flows of logs and lumber in combination with an annual external audit on site by an independent certifying institute serve to fulfil the goals of sustainable timber use and thus meeting the PEFC requirements.

Based on the sustainable approach of the European forestry that is sparing on resources and which is monitored by a strictly controlled regulatory framework, construction with timber is sensible in all respects. Wood is available everywhere in our latitudes to sufficient extent and it is a natural resource that regrows continuously more than it is harvested. It is therefore no surprise that the wood industry has been firmly rooted in Europe ever since.

Climate protection and resource protection

Carbon cycles in nature

The carbon cycles in nearly all ecosystems are decisively characterised by photosynthesis, as it supplies all creatures with energetic elements and sources of energy. In the course of photosynthesis, plants take up carbon dioxide (CO_2) from the air during their growth, as well as water and nutrients from the soil, and build their growth and textural structure from this. For trees, this basic structure is wood. During the photosynthesis process, the low-energy oxygen molecule is decomposed in the green leaves of the plants by means of light. Oxygen (O) that is vital for most living beings and created as a decomposition product this way is released again to the environment.

Carbon (C) in contrast serves for the organic structure of the tree and remains bound in the form of biomass for its entire lifecycle. This way, the plants continuously extract the greenhouse gas carbon dioxide (CO_2) from the atmosphere (see Figure 3). Biomass is understood to mean wood, leaves, roots and humus. As soon as the biomass dies off, carbon dioxide is released again through decomposition and the natural cycle is closed.

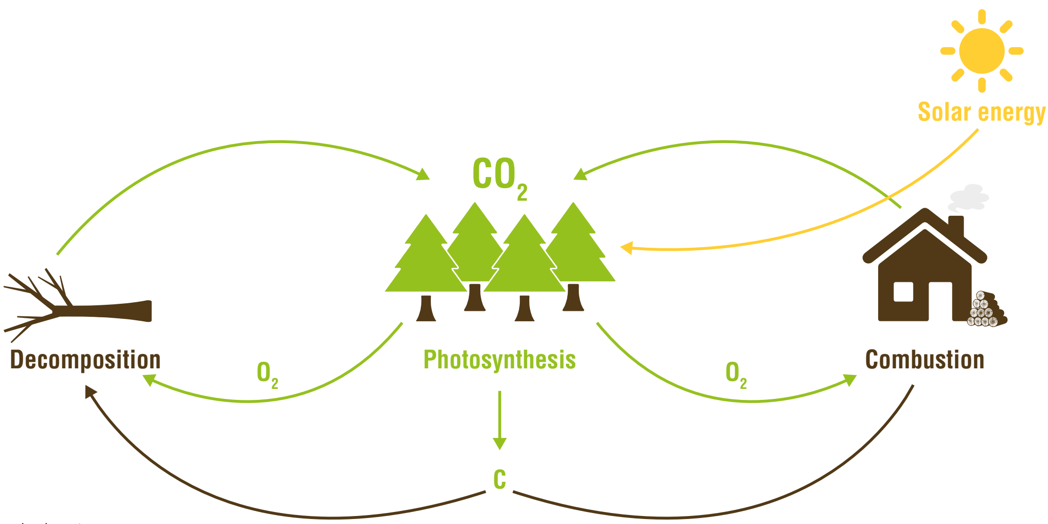

Figure 3 – Carbon cycles in nature

The forest as a carbon drain

In times of rising CO_2 emissions due to increasing anthropogenic emissions, groomed and stable forests through regulated forestry, like they can be found in all of Northern and Central Europe, are one of the decisive factors in the reduction of the CO_2 load in the atmosphere.

The graphic below shows how important a regulated forest cultivation by means of forestry management is (see Figure 4). While the carbon balance in an unmanaged forest remains balanced due to the dying off and rotting of trees, the balancing in a cultivated forest takes a different course: when wood is harvested, the carbon remains stored in the harvested wood – meaning the rotting phase is simply skipped. If the cultivation of the forests was discontinued, there would be neither wood products storing additional carbon nor biomass that might replace fossil energy carriers. Thus, global warming would progress even faster. Therefore, non-cultivated forests are less beneficial for the atmosphere than cultivated forests. This is so because the wood cannot be used and the natural rotting causes that the CO_2, which has been absorbed by the tree during its growth phase, is released to the atmosphere again.

CO_2-sequestration - long-term deposit and storing of carbon

Based on the ability of trees to store it for the long term, even after the harvest, not only the forest but foremost also buildings, furniture or even toys made of wood contribute as carbon stores to the reduction of the CO_2 content in the atmosphere.

As a rule of thumb, 1 m³ of wood stores nearly one tonne of CO_2 equivalents from the atmosphere. Extrapolated, this means that the Austrian forest stores approx. 3 billion tonnes of CO_2 equivalents. This is almost 35-times as much as greenhouse gases emitted by Austria per year. Trees bind carbon dioxide and store it as biogenic carbon over a long period. Every used trunk creates space for new trees and increases the carbon store in the wood. Buildings with wood therefore make sense in all aspects, especially since wood is available to sufficient extent everywhere in our latitudes. At the same time, it is a natural and sustainable raw material that can be subject to a comprehensive natural cascade as a cyclical material.

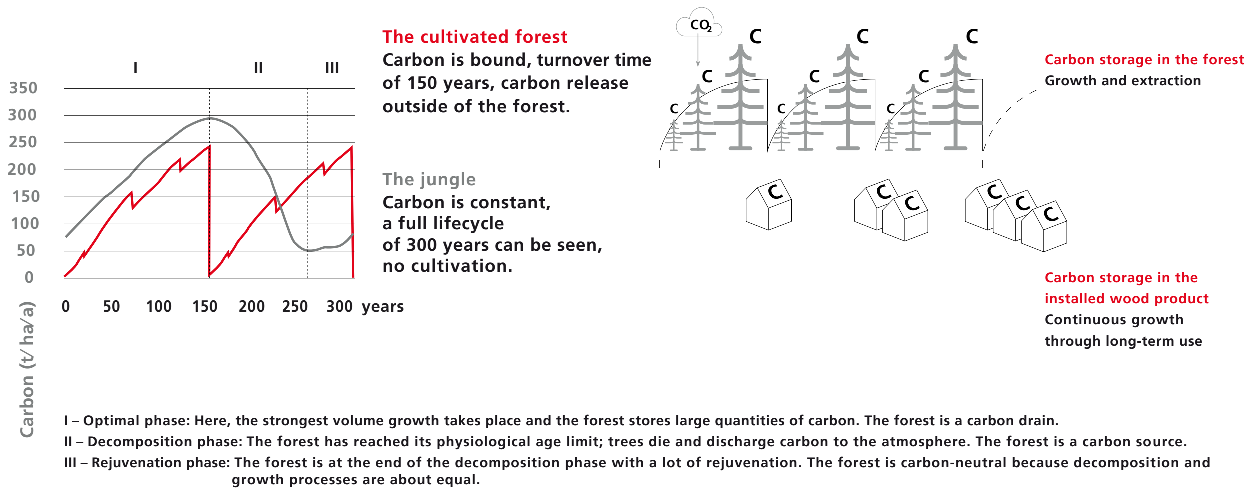

Figure 4 – Effects of the carbon drain between the forestry and the jungle, Zuschnitt 65, proHolz Austria

Figure 5 – Dalston Lane in London: In this project, CLT BBS binds approx. 3,000 tonnes of CO_2, which is equivalent of about 1,500 flights from London to New York City.

How much wood is needed to manufacture 1 m³ CLT BBS?

For the manufacturing of high-quality cross laminated timber CLT BBS, only suitable boards with certain strength properties and surface qualities can be used. For this reason, about 2.3 m³ of log wood are needed for 1 m³ CLT BBS. This quantity of wood regrows alone in Austria's forests as soon as after 2.3 seconds.

But what happens with the rest of the wood?

Before cutting the wood in our chip removal timber mills, the rind, which is approx. 10% of the volume, is removed from the trunk and converted into biomass directly on site in our timber mill. This biomass is converted into green electricity as well as heat for drying our woods. 58% of the log can be processed further into high-quality solid timber products. 0.7% of the volume of one log is then extracted from the wood through drying in our drying chambers. Another 20% that we convert again into milling by-products is eliminated when cutting open or planing the individual boards.

Thus, no waste is created in the production of CLT BBS; the entire log is processed sensibly. As the wood additionally originates from forests that are kept under sustainable management, building solid timber houses is no problem for our forest either, quite the contrary even. Cultivated forests have even more CO_2 storage capacity than non-cultivated forests, and thereby make an even bigger contribution to climate protection.

4,500 m³ binderholz CLT BBS, thus the complete Dalston Lane (see Figure 5) regrows alone in Austrian forests within just 2 hours and 52 minutes. Someone building a solid timber house thus not only does himself something good but also the forest and the entire environment.

Examples of CO_2 storage in buildings

If 10% of all houses in Europe were built of wood, the carbon emissions would reduce by an entire 1.8 million tonnes per year (rounded 2% of the entire carbon emissions).

The devastating earthquake in L'Aquila (Italy, 2009) cost 70,000 people their homes. They were to be reconstructed in high-quality and earthquake-proof construction design. binderholz CLT BBS emerged as the winner in the international tender procedure. Overall, 11,000 m³ CLT BBS were delivered and thus 29,600 m² of residential area were created. In the Austrian forest, 40 m³ of wood regrow per minute. Thus, it takes just 7 hours until the wood delivered to L'Aquila had regrown in the Austrian forest. In these 11,000 m³, 25,300 tonnes of CO_2 are bound for the long term. This is as much CO_2 as 1,000 Europeans or 5,000 cars per year emit on average (see Figure 6).

Each cubic metre of wood that is used as substitute for other building materials, reduces the CO_2 emissions in the atmosphere by 1.1 tonnes on average. When adding this to the one tonne of CO_2 that is stored in the wood, approx. two tonnes of CO_2 are stored overall in one cubic metre of wood.

Regional character based on short distances

Forestry management and the wood industry are usually staffed to greatest extent by regional employees and use the local raw material supply. Accordingly, the industry outside of the large urban centres offers plenty of jobs and occupational opportunities while it simultaneously assures a long-term regional value creation, and leads to an additional strengthening and stimulation within the regions through investment programs of the businesses.

Direct transport routes in the wood harvest and short distances for the creation of wood products or their semi-finished goods additionally contribute to the reduction of CO_2 emissions. The same applies to the production of the well-known plasterboards.

Transport by cableway

Around 15 kilometres on roads separate the mine in Grundlsee from the plasterboard in Bad Aussee (see Figure 7). The cable car saves the environment 22,800 trips by truck each year on this route and thus more than 350 tonnes of CO_2 emissions.

On export transports, too, wood saves emissions because wood transports on roads become inefficient from distances of 150 km, which is why these mostly take place by railway. In addition, the exported wood contributes in the importing countries to savings of CO_2 emissions – because they substitute energy-consuming building materials there as well.

Consumption in everyday life – CO_2 emissions

FLIGHT round trip	Munich – Mallorca	0.5 tonnes
	Munich – Tenerife	1.2 tonnes
	Munich – New York	2.4 tonnes
TRIP BY CAR 12,000 km	Small vehicle, petrol	2.8 tonnes
	Small vehicle, diesel	3.0 tonnes
	Off-roader SUV, petrol	6.7 tonnes
	Off-roader SUV, diesel	7.2 tonnes
NUTRITION per year	Heavy on meat	1.6 - 3.2 tonnes
	Vegetarian	0.9 - 1.8 tonnes
	Vegan	0.8 - 1.6 tonnes

Figure 6 – CO_2 consumption in everyday life

Figure 7 – Cable car of the plasterboard factory in Bad Aussee | Austria

Efficiency factor of forestry and wood

In Austria, about 280,000 people earn their livelihood in the forestry and wood industry, whether directly in the forest, in sawmills or in the further wood-processing industry. This number does not even include the employees working in the industries that are merely indirectly related to the wood industry such as the timber and building material trade. A similar pattern is found in Germany with 648,000 employees alone in the wood industry. When adding up the employees of the entire cluster consisting of forestry and wood industry, the number even exceeds the number of employees in the metal and electronics industry (see Figure 8).

The wood industry in Austria has approx. 1,500 businesses, of which the large majority, notably 1,200, are sawmills. The most important branches – as far as the production output is concerned – are the sawmill segment, furniture industry, construction, derived timber products segment and – how could it be different in Austria – the ski industry.

Occupations and personnel requirements have strongly evolved in recent years in consequence of various technical innovations, increasing automation and progressing digitalisation. There is a correspondingly large variety of professional opportunities that are represented in the industry: the bandwidth ranges from lumberjacks and wood engineers to industrial clerks and IT specialist and even includes controllers, lawyers and marketing experts.

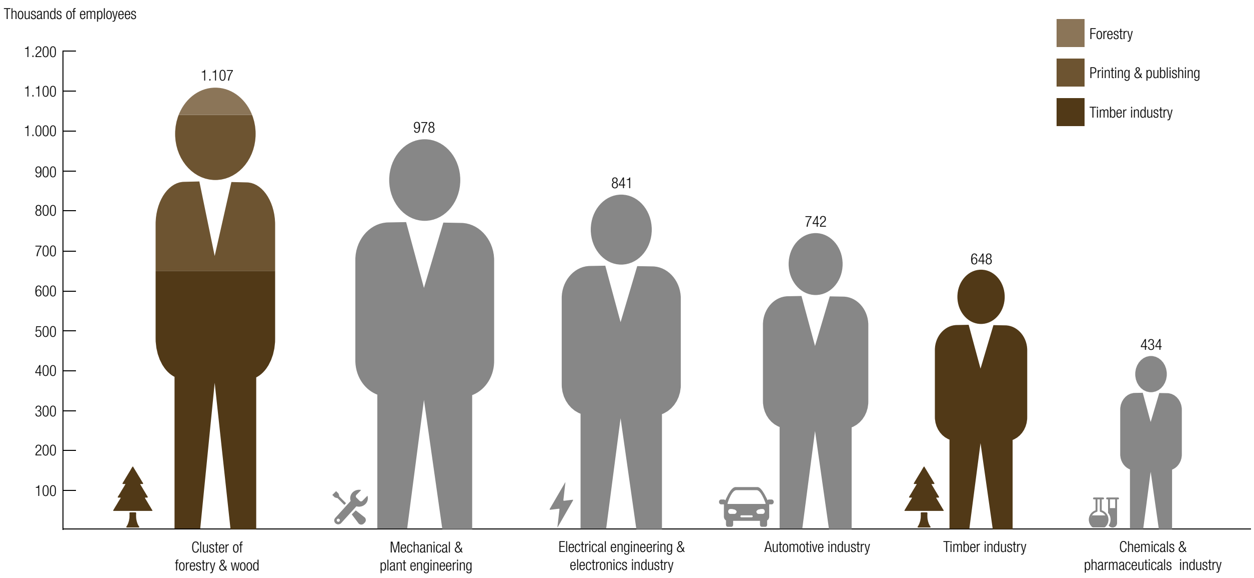

Figure 8 – Employees in the cluster of forestry & wood in Germany.

Great value, big benefit

The German milling industry quantifies the annual turnover of its 2,000 businesses at rounded EUR 5 billion. In the year 2017, the sustainable overall annual wood harvest of the German forestry was at around 53 million solid cubic metres of wood without rind. Of this, about 35 million solid cubic metres of logs were cut and processed further by the German sawmill industry.

In Austria, the overall timber industry earns EUR 6.12 billion per year. More than 70% of the domestic products are exported – primarily to other EU countries, the major part of which goes to the neighbouring countries Germany and Italy. With an export surplus of EUR 3.08 billion, the Austrian timber industry is practically at even par with tourism as a source of foreign currency.

Of the more than 17 million harvested solid cubic metres without rind, which are harvested annually in Austrian forests, the largest part initially goes to the sawmill industry, which conditions the raw log product for the processing sectors such as the furniture manufacturers or the construction industry. 63% of the annual pinewood harvest with 14.57 million harvested solid cubic metres goes to the sawmills, 16% are used in the industrial timber segment and 21% are used energetically (see Figure 9). The pinewood use of 98% in the sawmill industry is substantially above that of hardwood at 2%. Similar as in the German timber industry, the Austrian timber industry is also reliant on imports of log wood so as to be able to cover the rising demand.

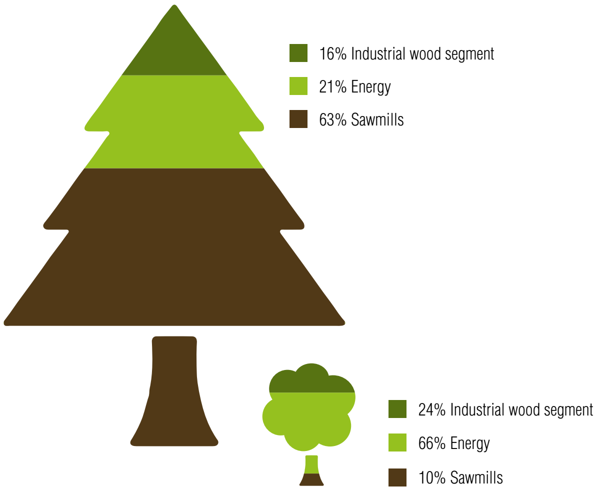

Figure 9 – Wood harvest in Austria in cubic metres harvested without rind, wood harvest report for the year 2015.

The zero-waste principle of binderholz

The top priority of binderholz is to use the raw material wood in the optimal way. At binderholz, therefore, every part of the log is assigned to its most efficient use that is most sparing on resources. This way, the lumber from the sawmill is processed further into the constructive solid timber components such as solid wood panels, gluelam or cross laminated timber CLT BBS that is used in modern timber construction.

To extend the useful life, the so-called cascade of timber products, additional possibilities for use are offered: The by-products that arise from the lumber production, such as the rind, wood chips or sawdust can be used as energy carriers for a climate-neutral generation of electricity and heat in biomass heating plants or they can be purchased in the form of pellets and briquettes as biofuels for private households. As an additional possibility for use of these by-products, further processing in the wood material and pulp industry suggests itself. Thus, the log is used to 100% and no waste burdening the environment is created (see Figure 10)!

Highly skilled timber construction businesses, wood construction engineering offices and architects bring the lumber generated this way to the best possible use in the construction sector – creating energy-efficient timber houses, multi-storey residential projects or even high-rises made of wood!

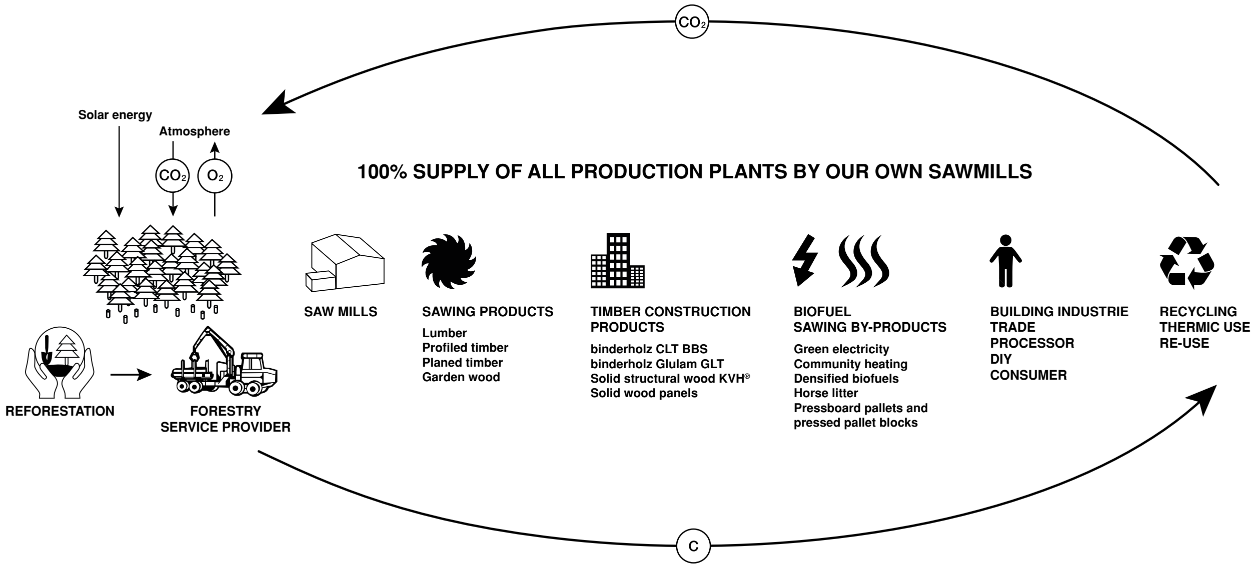

Figure 10 – Zero-waste principle

Timber construction in facts and figures

Every 40 seconds, enough wood regrows in the Austrian forests so that a complete single-family home could be built from it.

It takes one second for one cubic metre of wood to regrow in Austria. This would be sufficient building material for 2,160 single-family houses per day. In one year, enough wood for 788,400 houses grows in Austria without harvesting from existing forests.

According to the latest state of knowledge, timber buildings can be constructed up to 20 storeys high. One of the highest residential timber buildings of the world with nine storeys is located in London and was built in 2008 already by an Austrian company: the Dalston Lane.

International studies attest to a great future of timber construction. While the ecological component has been decisive until recently, strong economic arguments are now increasingly coming into play. This thesis is underpinned by the already high timber construction quotas in various countries and the continuously rising portion of timber in the construction industry (see Figure 11).

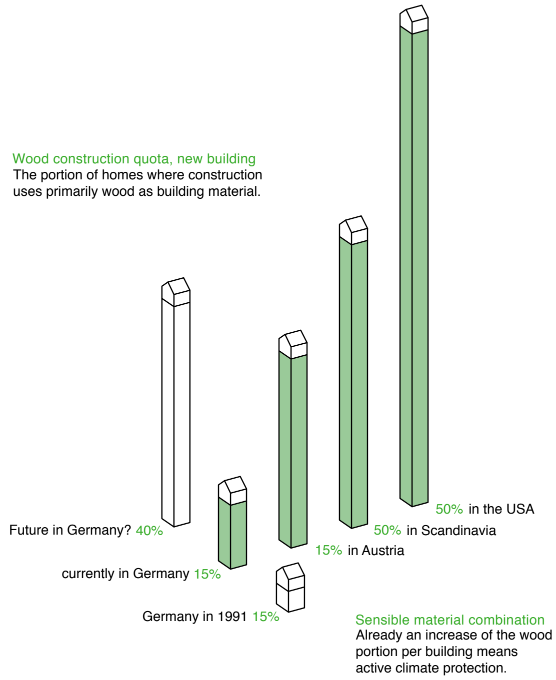

Figure 11 – Timber construction quotas of select countries, Holzforschung [Timber Research] Munich

Timber construction: Wood and its benefits

Wood is the most frequently selected building material when it is about low-energy and passive houses. And this is for a good reason as experts know. Wood accomplishes to fulfil the building physical requirements to the greatest extent. Many people decide in favour of wood because of its room climate characteristics: the pleasant surface temperature and the ability to balance temperature and humidity peaks. Wood has a positive effect on people's well-being and thus on their health – this, too, is an economic factor.

Projects such as the reconstruction of the region struck by the earthquake around L'Aquila in Italy impressively prove the capacity of the solid timber system construction design. Of all building materials, wood has the best ratio of weight to load-bearing capacity. It is not only suitable for realising buildings of solid timber construction on particularly difficult parcels of land, for example, on mountain ridges in Zillertal of Tyrol, but also for constructing roof structures on pre-war houses in Vienna's city centre.

Building redevelopment: renovating, modernising and densifying with wood

For building redevelopments, solid timber construction in combination with dry construction systems offers big advantages compared to other building materials given the possibility for pre-fabrication and the related short construction periods, the low weight, the positive CO_2 balance and the ecological profile.

The thermal renovation of buildings has been sponsored for many years by states and municipalities. Structural improvements are considered to be an effective means to reduce the emission of CO_2. Well-insulated building parts made of solid timber, which can be installed on site within a short time, represent an interesting alternative to the common methods.

In densely populated cities, there are hardly any open areas available for new buildings. Existing buildings offer greatest potential for modernisation and re-densification.

Construction designs for the inventory are in demand that can be implemented efficiently, quickly, without a lot of disruption and with precision. Timber construction in various pre-fabrication stages offers solutions for this (see Figure 12). The use of solid, pre-fabricated building elements made of CLT BBS saves long construction periods on site and thereby results in less disruptions of the operating processes or the residential surroundings. After all, besides residential construction, especially also public buildings such as schools, child care centres and administrative buildings are in need of being renovated while they are open for business. Here, the use of building parts that are to the greatest extent pre-fabricated has decisive advantages.

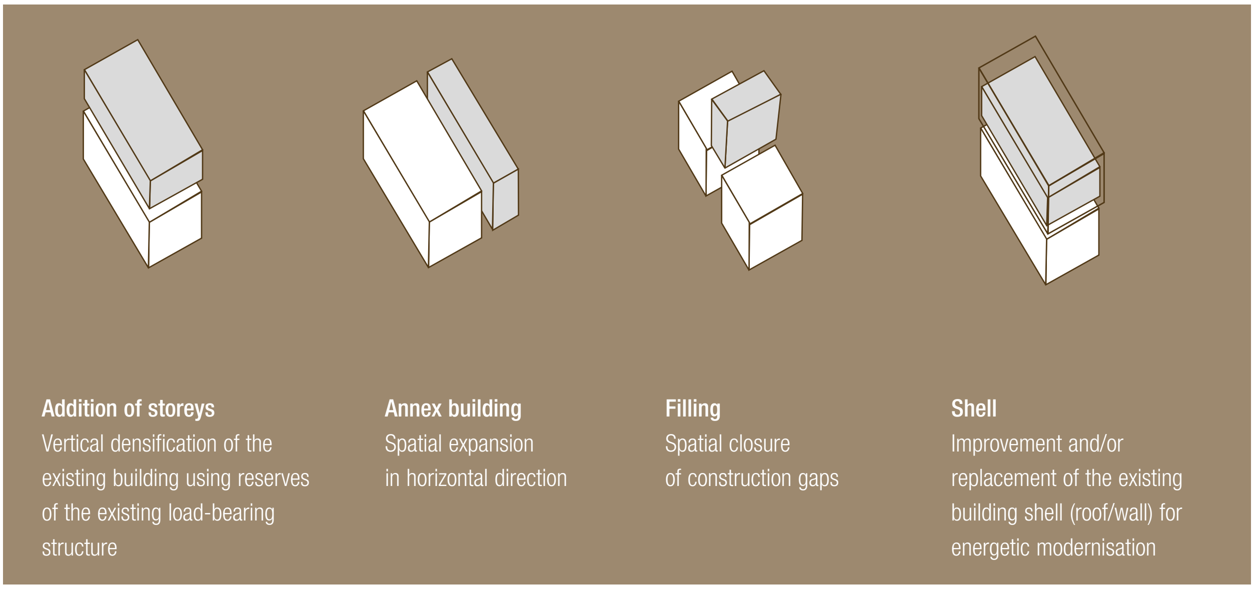

Figure 12 – Building redevelopment with wooden elements, proHolz Austria

Efficiency of solid timber buildings

The high degree of internal pre-fabrication in the manufacturing of timber construction elements permits a standardised production that is independent of the weather in steady and verifiable quality. Even humidity and temperature is prevalent in the production halls. The assemblers work in good framework conditions while the following trades such as electrical and sanitary installations are prepared to the point that the construction progress moves ahead in a coordinated and swift manner. In addition, the processing of the construction site is simplified, as the wooden elements are delivered on time and unnecessary waiting times can thereby be avoided. The lower deadweight of the timber structures reduces the construction effort for the building foundation and baseplates. The construction site equipment can be kept at a minimum and the logistics expense is lower. The dry construction design of the timber structures reduces the construction periods significantly, as the drying times for brickwork or screeds are eliminated. Thus, an exactly calculable construction period can be determined, which enables using the buildings sooner and which, in turn, reduces the financing periods.

High efficiency through CLT BBS

The savings of time through timber construction of binderholz CLT BBS can be substantial in the construction of large-volume buildings. The high degree of pre-fabrication drastically shortens the construction phase for large-scale projects because carrying wall elements merely have to be aligned and conjoined with each other. Based on their comparably low weight, these pre-fabricated timber elements can have very large dimensions.

Ecobalance and cascade use of wood

An ecobalance lists all processes that are relevant in terms of the environment and which arise throughout the lifecycle of products and materials. This includes, among other factors, emissions arising in the transport of semi-finished goods or that result from the energy generation for the production. The system limits of an ecobalance can vary depending on the product type and the product lifecycle (see Figure 13).

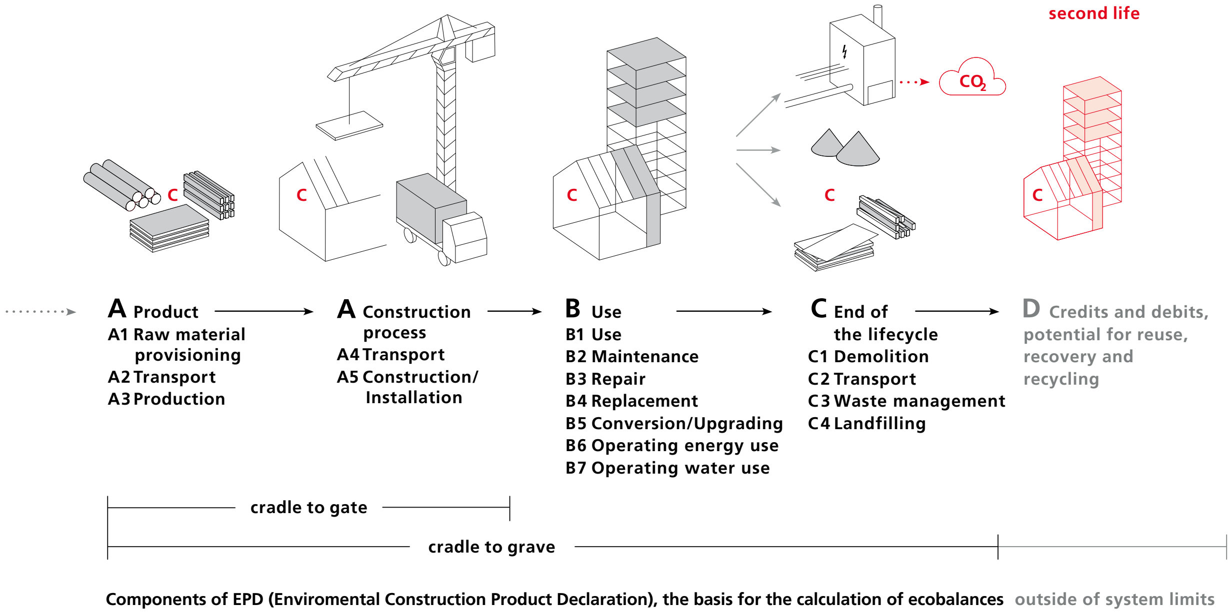

Figure 13 – System limits in the construction wood production, Zuschnitt 65, proHolz Austria

Product lifecycle and utilisation cascade

Phase 1 – production chain: from the tree to the product

During the entire production covering the harvesting of the trees, the manufacturing, processing of the products (sawing, surface treatment, assembly, etc.) and the transport to the construction site, as well as assembly, the energy expended (the so-called “grey energy”) is much lower than for other construction methods.

Environmentally relevant data for basic building materials and wood

Building material	**Density** **ρ** [kg/m³]	**Acidification potential** **AP** [g/kg]	**Greenhouse gas potential** **GWP100** [kg CO_2-eq/kg]	**Primary energy concentration** **PEI relative to mass** [MJ/kg]
Bricks – honeycomb brick	1200	0.541	0.19	2.5
Reinforced concrete	2400	0.55	0.167	1.22
Wood – spruce lumber, planed, techn. dried	450	1.51	-1.63	3.21
Wood – solid wood panel PF 3 layer	450	2.25	-1.38	7.58

Phase 2 – use: Energy requirement

During the use, energy consumption, and the maintenance and repair of a building play a key role. In heat insulation, timber houses are at the highest standard. By nature, wood has air-filled cells whereby heat and cold are conducted to substantially lesser extent than in other building materials. During the winter, the cold penetrates only to insignificant extent and during the summer the heat is kept outside. Even in the standard construction design, timber houses keep effortlessly within the consumption values mandated by law. With sufficient insulating layers, the passive and 3-litre construction design is easily realised with the timber house. The low residual energy requirement enables a correspondingly small dimensioned heating system. According to the Austrian standard ÖNORM B 2320 a useful life of at least 100 years can be expected for timber houses constructed professionally.

Phase 3 – recycling, sorted dismantling and demolition

The recycling capacity of buildings and building materials is becoming increasingly important due to the future shortage of resources. The waste of residual construction masses consisting of construction rubble and concrete debris is around 5 million tonnes per year, which accounts for 18% of the entire construction waste. In the analysis of the waste accumulated during dismantling, a reduction of the waste volume is indicated with the increasing application of timber construction designs. Furthermore, the wastes resulting from this indicate a high potential for utilising the material and the energy, whereas the utilisation efficiency can be further raised through the development of construction designs that are appropriate for recycling. The aspiration of integrating the installed elements and components as far as possible in another constructive lifecycle is therefore closely suggested. Here, the monolithic and homogeneous construction design of cross laminated timber CLT BBS must be considered to be very advantageous, as it omits an additional material separation. “Today’s” choice of materials thus affects “tomorrow’s” wastes, which is why it must already be ensured in the planning process that materials are installed in such a way that they are easily available and broken down at the end of the lifecycle, and so that they can be used in the optimal way in terms of their components (“design for recycling”) or for energetic purposes (“design for energy”). In this connection, the timber construction design has an advantage, as wood can be manipulated more easily and be demounted ideally and be re-used as a complete component in high quality. The lifecycle will then start over again.

This way, a timber house that is dismantled after its use does not leave any non-recyclable rubble but useable wood. Individual components or elements can be re-used or be returned to the manufacturing process. The remaining wood is added to energetic use. This way, the CO_2 continues to remain bound in each piece of installed wood and it thereby does not reach into the atmosphere for until the wood is used thermally in the last recycling step.

DRY CONSTRUCTION WITH SAINT-GOBAIN RIGIPS AUSTRIA

Saint-Gobain is one of the oldest industrial enterprises of the world. As a sustainable building materials company, it takes its role-model function very seriously. The focus in the future as well will be on the sustainable and affordable structural engineering. At the same time, Saint-Gobain is also increasingly dedicated to building certification to offer practicable and sustainable solutions. The global challenge of the shortage of resources plays a likewise significant role besides energy efficiency. For Rigips, particular attention is paid in this regard on reducing specific consumptions and supporting recycling management.

Objectives

In the subject of sustainability, the Sustainable Development Goals (SDG) of the United Nations will set the keynote in the future. Saint-Gobain Rigips Austria has evaluated all 169 sub-goals (see Figure 14) for potential effects on the core business. These results are a part of the business strategy.

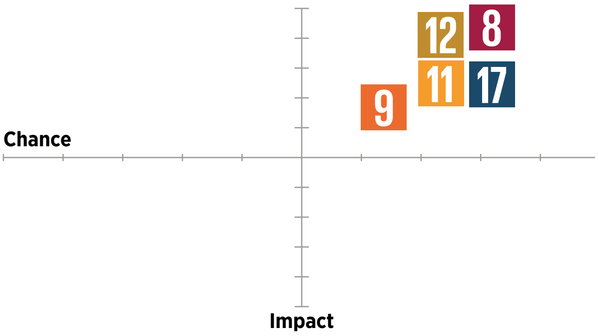

Figure 14 – Central goals of Rigips Austria

Gypsum - the raw material

Rigips Austria is aware of the great responsibility the construction industry has towards the environment. During the entire production process and in the product lifecycle, measures are taken specifically to minimise the effects on the environment.

Gypsum has been used as a building material for more than 5,000 years. The natural stone occurring as a raw material is recyclable to 100% and for infinitely many times, and it is harmless to the skin as well as fire-resistant. The production process (see Figure 15) is completely reversible: through dehydration, water is extracted from the rough stone and gypsum powder is created. When water is added to the gypsum powder, you will receive gypsum again.

Figure 15 – Production process of Rigips Austria

The natural raw material gypsum is extracted from a mine near the factory and the water required comes from a river near the factory. The cardboard originates primarily from Germany, while the percentage supplied from Austria is continuously increasing.

To constantly develop the production processes further in terms of their (energy) efficiency, the WCM (World Class Manufacturing) is established at Saint-Gobain as the management system.

Compared to dry construction solutions with traditional construction methods, light-weight construction with Rigips is clearly in the lead:

- fewer natural resources per m² useable area are needed for production.
- The energy consumption in production is lower.
- The CO_2 emissions are lower throughout the entire lifecycle.
- Great savings of time result during the pre-fabrication in the factory as well as during the assembly at the construction site.
- Dry construction systems offer flexible design options.
- Gypsum is 100% infinitely recyclable.

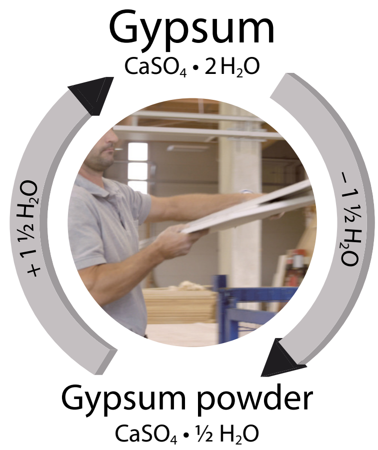

Figure 16 – Recycling cycle of gypsum

Recycling

In the mining of Rigips Austria, in Grundlsee and Puchberg, gypsum is extracted in surface mining. As the raw material deposits are limited, the return and use of scraps are top priorities. The aim is to continuously develop the recycling service range further and thereby raise the recycling quota of the boards (see Figure 16). At this time, 6% of each Rigips board is manufactured of recycling material already – the mid-term target is 10% and in the long term, 30% of a Rigips board is to consist of recycled material.

Transparency – environmental product declaration

Environmental Product Declaration (EPD)

To evaluate the sustainability of buildings, data about the installed building materials are needed. An Environmental Product Declaration (EPD) provides information about the environmental effects of individual products or building materials, thereby forming the basis for a building certification. Besides Environmental Product Declarations for all boards produced in Bad Aussee (33 product EPDs), Rigips Austria is also providing 63 declarations for relevant Rigips wall and ceiling systems since 2016 (see Figure 17). The data is available at any time (also at www.baubook.info) and helps in the planning according to requirements for the use of sustainable construction products.

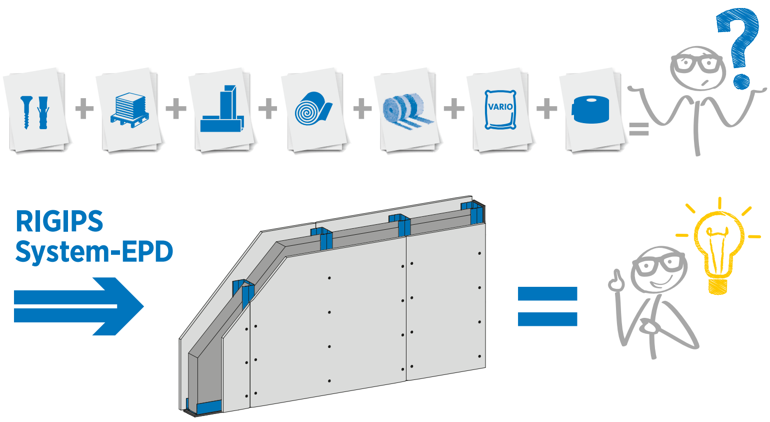

Figure 17 – Development of the EPD Rigips System

Multi-comfort

People spend up to 90% of their time indoors, which is why topics such as room climate, living comfort and affordable residential space are also important to Rigips Austria. The multi-comfort concept (see Figure 18) is an important means for Saint-Gobain to set standards in terms of comfort, sustainability and energy efficiency as a reference for creating and sustainably designing living spaces. The focus is on the users' comfort and the verifiable added values for all involved in the construction: everyone from the property owner to the planner, architect, contractor and dealer.

Foremost the following six dimensions are of central importance:

Figure 18 – Six dimensions of the multi-comfort concept

Innovation

For Rigips Austria, responsibility towards the market and society has a high priority. Sustainability, especially in terms of innovation and the environment, is very important to Rigips.

Timber construction is one of the strongly growing business fields. Innovative Rigips systems are the ideal addition to timber construction. At the same time, the natural advantages of the building material wood are combined with those of the Rigips systems.

Innovation Riduro wooden building slab

Rigips Riduro wooden building slaps are fibre-reinforced plasterboards for use as reinforcing planking in timber frame construction and for increased sound insulation in solid timber construction.

The Riduro wooden building slab newly developed in Austria stands for:

- improved cohesion of the structure
- high flexural stiffness
- easy processing
- flexible jointing technique
- strong resistance under impact load

Besides the leaner fire protection solutions, the board stands out for its ecological evaluation (EPD) and a top price-performance ratio. 100% recyclability is the standard for products from Bad Aussee.

Employee commitment in the course of the world depletion day

The world depletion day marks the day in the year from which onward the earth can no longer regenerate all natural resources on its own. On occasion of this day, Rigips Austria has initiated seven workshops at its three sites. The employees' involvement and commitment was very strong. It was worked on topics such as sustainable civil engineering, my personal contribution to environmental protection, reduction and avoidance of emissions and energy consumption, as well as health and work safety; and concrete implementation activities were defined.

Rigips Austria is proud of its dedicated employees, who are committed to leaving behind a world worth living in for future generations and who are also willing to make their own contribution to this.

Key indicators

Rigips Austria publishes key figures on the sustainable development of the company every two years.

From 2015 to 2017, the following could be achieved, for example:

- 350 tonnes of CO_2 savings per year through the transport of the rough stone by cable car (investment of EUR 7 million for modernisation)
- LED lighting project:
  30 tonnes of CO_2 savings per year
  Improvement of luminosity: > + 200%
- Concentration of 6% recycling material in the boards produced in Bad Aussee

List of figures

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Rigips
SAINT-GOBAIN

Binderholz Bausysteme GmbH
A-5400 Hallein / Salzburg
Solvay-Halvic-Strasse 46
Tel.+43 6245 70500
www.binderholz.com

Saint-Gobain Rigips Austria GesmbH
A-1230 Vienna
Gleichentheilgasse 6
Tel. +43 1 616 29 80-517
www.rigips.com