Resource efficiency in practice

We know that the world’s growing population is putting increasing pressure on global resources and that the world’s current consumption patterns are simply not sustainable in the longer term. As the world’s finite supply of fossil fuels diminishes, in direct contrast to the increasing demands of a larger population, we will need to move to a circular economy based on renewable resources and optimum efficiency. In contrast to the linear model of take, make, dispose, a circular economy is a framework that takes insights from living systems. It considers that our systems should work like organisms, processing nutrients that can be fed back into the cycle, whether biological or technical, which is where phrases such as “closed loop” or “regenerative” come in.

It’s also why we believe Europe’s paper industry has a very bright future – because it is already a benchmark model of resource efficiency and a perfect fit for the circular economy. It is inherently sustainable by nature: Based on renewable, recyclable raw materials, Europe’s paper industry can produce second-generation biofuels to replace crude oil as well as renewable bio-based products. It provides packaging solutions to avoid food waste and it uses residues from the woodworking industry as its raw materials. These are just a few examples, you’ll find many more in the pages provided in this folder.

Resource efficiency in the pulp and paper industry
Making more from our natural resources

The story

Resource efficiency in practice

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The European paper industry is at the core of the bio-based economy because everything it produces comes from forest fibres, a primary, renewable resource. It takes all the components in wood and transforms them into value-added bio-based products. And that doesn’t just mean pulp and paper. Through the biorefinery concept, a paper mill is much more than the sum of its parts, making a vast range of innovative products. While wood fibre is used to make pulp, resin can be turned into chemicals and bark into renewable energy. Excess electricity is often sold to the grid or process steam pumped to heat nearby homes. By getting the most that it can from its production process based on renewable resources, Europe’s paper industry provides the ideal path from a fossil-based to a bioeconomy.

Living the circular economy

Once the paper has served its purpose, the industry recycles that paper to make something new, which makes a lot more sense than burning it or sending it to landfill as waste. Along the way, it creates additional products from the residues of the recycling process, adding value and innovation. Old paper cannot be recycled indefinitely – it needs a influx of new wood fibres to keep going otherwise the fibres wouldn’t be strong enough to make new products. Those new fibres come from renewable, sustainably-managed forests, continuing the loop.
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Partnering in the carbon cycle

When it comes to the carbon aspects of resource efficiency, we must understand the carbon cycle and think beyond energy savings and related CO₂ emissions. Like water and oxygen, carbon is an essential element of life on earth. Through the natural process of photosynthesis, trees use solar energy to sequester atmospheric carbon into wood.

What makes the wood-based industry unique is that it uses trees to further store that carbon in products such as pulp and paper. Then, at the end of the product’s lifetime, it can also be used as bioenergy, hence releasing the carbon previously sequestered and stored. Some 56% of the pulp and paper mills’ energy consumption is bioenergy.

These renewable products and energy, substitute their fossil-based alternatives, which emit in a short timeframe the carbon sequestered over millions of years. In the latter, the carbon cycle becomes unbalanced and CO₂ is accumulated in the atmosphere with its impacts on climate change.

In contrast, demand for renewable products and energy imparts value to wood and thereby ensures forest land continues to be covered by trees.

It contributes to sustainable forest management and to the continued capability of forests to sequester carbon. It’s a green cycle!

The European paper industry is strongly committed to sustainable forest management and uses wood certified to PEFC and FSC standards to prove it. In Europe, more trees are grown than harvested and, thanks to continuously-improving standards of forest management, Europe’s forests are growing bigger every day. In fact, they grew 12,000 hectares from 2009-2010 and are 3% larger than in the 1950s. To put it another way, European forests are increasing by 1.5 million football pitches every year, an area four times the size of London.

Some 90% of the wood used by the European paper industry comes from European forests. It is sorted carefully to make the best use of each particular grade. The wood comes partly from final fellings or from parts of the trees that are not used in the sawmilling industry, such as the tops and branches. Some wood arrives at the pulp mill in the form of residues from the woodworking industry.

It’s all part of the principle of the cascading use of wood – a resource-efficient way of using our raw materials.

56% of the pulp and paper mills’ energy consumption is bioenergy, equating to 20% of European bioenergy consumption.

On the thematic pages included in this folder you’ll find lots of examples of how the pulp and paper industry is already living the circular economy. To find out more, don’t hesitate to get in touch: www.cepi.org/resourceefficiency
The forest: where it all begins

The European paper industry is strongly committed to sustainable forest management and uses wood certified to PEFC and FSC standards to prove it. In Europe, more trees are grown than harvested, and, thanks to continuously-improving standards of forest management, Europe’s forests are growing bigger every day. In fact, they grew 12,000 hectares from 2009-2010 and are 30% larger than in the 1950s. To put it another way, European forests are increasing by 1.5 million football pitches every year; an area four times the size of London.

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512,000 hectares of additional forests in 5 years

20% of all damaged football pitches

82% of our raw materials come from Europe

$12,000 hectares of additional forests in 5 years

1.5 million football pitches

We produce 82% of our products from wood.

Some 90% of the wood used by the European paper industry comes from European forests.

In the case of paper, the cascading use of wood means that, with 1m³ of wood, the industry creates 2.38 times more products and energy as compared to using that cubic meter in a single use.

Partnering in the carbon cycle

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What makes the wood-based industry unique is that it uses trees to further store that carbon in products such as pulp and paper. Then, at the end of the product’s lifetime, it can also be used as bioenergy, hence releasing the carbon previously sequestered and stored. Some 56% of the pulp and paper mills’ energy consumption is bioenergy, equating to 20% of European bioenergy consumption.

These renewable products and energy, substitute their fossil-based alternatives, which emit in a short timeframe the carbon sequestered over millions of years. In the latter, the carbon cycle becomes unbalanced and CO₂ is accumulated in the atmosphere with its impacts on climate change.

In contrast, demand for renewable products and energy impacts value to wood and thereby ensures forest land continues to be covered by trees. It contributes to sustainable forest management and to the continued capability of forests to sequester carbon. It’s a green cycle!

When it comes to raw materials, the forest industry is blessed with a fundamental advantage compared to those who depend on finite resources. Why? Because its basic raw material, wood, is renewable, recyclable and sustainable. That’s because the wood comes from forests which are carefully managed to the highest standards, as they keep growing in area and volume while still delivering the wood the industry needs.

Using non-renewable resources is like living off your savings. Using sustainably-managed wood is like living off the interest.

Sustainable forest management, Europe’s forests are growing bigger every day. In fact, they grew 12,000 hectares from 2009-2010 and are 30% larger than in the 1950s. To put it another way, European forests are increasing by 1.5 million football pitches every year; an area four times the size of London.

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The European paper industry is blessed with a fundamental advantage compared to those who depend on finite resources. Why? Because its basic raw material, wood, is renewable, recyclable and sustainable. That’s because the wood comes from forests which are carefully managed to the highest sustainable standards, so they keep growing in area and volume while still delivering the wood the industry needs. Using non-renewable resources is like living off your savings. Using sustainably-managed wood is like living off the interest.

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#### The European Wood Flow Analysis

The European Wood Flow Analysis (EWFA) knowledge on the wood flow in Europe at the different steps of wood use from the lower-in wood-based products to bioenergy. It quantifies the amount of wood harvested and compare it with the annual growth and the remaining potential. It visualizes how much wood is used by the different industries and how the residues of one sector are used by others. By doing so, cascade factors can be calculated.

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#### Poster

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**Poster**

- **Annual growth potential and actual harvest in Swedish forests**
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Wood: The renewable heart of the sector

The basic raw material for the paper industry is wood. Wood can be used in many different ways to generate a vast range of sub-products in many industrial sectors. A tree is made up of several different components and all can be put to good use. The tree’s cell wall is made up of cellulose (the fibre) and hemicellulose, which has shorter molecule chains and so less strength, but which can be easily synthesised to make other things. Binding it all together is lignin.

% may vary by species of wood

45% Fibres

- Shampoo
- Viscose for textile
- Hygiene papers: diapers, tissues, toilet paper
- Lipgloss
- Textile patterns

30% Binding materials

- Carbon fibre (Fishing products or cars)
- Additives for concrete
- Biodiesel
- Grease (enhancing corrosion protection)
- Batteries (enhances power of batteries)
- Cosmetics (eye shadow or rouge)
- Vanillin
- Biocomposites

25% Sugar + Others (Hemicellulose)

- Pharmaceuticals
- Biocomposites
- Varnish
- Enhancers for hydrophobicity and thermal formability
- Strengthening agent in paper
- Chemicals
- Paper filters
- NANOCELLULOSE: Strong and super-flexible materials, Ultra-absorbent aerogels
- Pulp
- Paper
- Sponges
- Cellophane
- Batteries (enhances power of batteries)
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Borregaard: Leading the way

Norwegian company Borregaard is an example of one of the world’s most advanced biorefineries. It uses wood to make bio-chemicals, bio-materials and biofuel that can replace oil-based products. The Sarpsborg mill in Norway makes speciality cellulose which can end up in products in the construction and oil industries, foodstuffs, tablets, cosmetics, filters, hygiene products, textiles and paints, to name but some.

But it does much more than that. The wood’s binding agent, the lignin, is used in additives for everything from concrete and textile dyes to batteries and fishery products. The most important area of use for lignin products is as an additive in concrete. In addition to providing advantages in terms of strength and quality, the lignin also means that the water and cement content of the concrete can be reduced, resulting in a lower energy need and, not least, lower CO₂ emissions in the production of cement.

Lignin is also the source of the flavouring agent vanillin, the world’s most used taste and flavouring agent. Most of the world’s vanillin production is based upon petrochemical raw materials and Borregaard is the only producer in the world to make vanillin from wood at present.

Then there’s bioethanol, produced from the sugar in the wood. It can be used in the pharmaceutical industry, paints, varnishes, car care products, and as fuel in buses. The list goes on…

Turning agro waste into paper

FAVINI The paper industry is also working with alternative resources. One of these is waste from the agro-industrial sector, including waste from lemons, oranges, nuts, apples, corn and olives, now being used as a raw material for paper. The principle has been developed at Italian producer Favini who also came up with Alga Carta (a paper which uses algae as raw material).

The new paper, CRUSH, makes best use of a food waste which would otherwise be dumped, or perhaps burned for energy. Now that waste can be recycled, adding value and sustaining the circular economy.

Keeping resource use to a minimum: Fillers

Papermakers use fillers such as calcium carbonates to replace wood fibres and to increase the solids content of coating colour in most paper and board applications. Thanks to higher mineral contents of up to 50% with calcium carbonate, the amount of valuable fibrous raw material can be reduced. Adding calcium carbonate also allows paper machines to operate at higher speeds and the finished paper to dry more quickly (which saves energy).

(Source: Omya)

More information at

www.cepi.org/resourceefficiency
Recycling: An industry leading the way

Recycling is a vital part of European paper production. In fact, it's no exaggeration to say that the European paper industry is a champion in recycling. The paper industry has been recycling used paper and board for over 700 years, turning used paper products into new ones. The used papers are collected from households, industry and commerce and their fibres are recycled by the paper industry several times to produce new high-quality goods, fit for purpose, and not necessarily the same as before.

This is the perfect example of a circular economy, with the sector reaching a 70% recycling rate and aspiring to close the loop for the remaining potential, which today is not collected or exported outside Europe. And because full recycling potential is actually around 78% rather than 100%, since some products cannot be collected or recycled, it makes that 70% quite an achievement. The industry also thrives on adding further value to the residues from the recycling process. And when recycled fibres can’t be reused any more without an input of fresh fibres to give them strength, those new fibres are sourced from sustainably-managed forests, which are to a large extent certified in Europe.

In the last 20 years, Europe’s recycling rate has grown from 40% to over 70%, close to the maximum which is around 78%.
Source: ERPC, 2013

Together with the organisations in the supply chain of paper for recycling, CEPI has proposed to revise the European standard for grades of paper for recycling – EN 643. The new EN 643 now includes maximum tolerance levels for non-paper components such as metal cans and plastic bottles in deliveries of paper for recycling. This way, non-paper material is sorted out earlier in the supply chain and not only at the paper mill. The resource efficiency benefits are more paper for recycling, less transport and less waste management for the paper mill, which saves resources and costs. At the same time, the sorted out non-paper material can be made available to other value chains using waste.
Lucart spa, an Italian papermaker, has developed a process to recover the fibres in used beverage cartons and give them a new lease of life as high-quality tissue products. In so doing, it reduced its own wood consumption and embraced the principles of resource efficiency while turning waste into raw material. In the process, Lucart also recovers the aluminium and polyethylene present in beverage cartons and puts those to good use too. Creating a product patented under the name of ‘ALPE’, these other components of the carton gain a second life with manufacturing companies that use them as a raw material for the production of pallets and articles for the building sector, for example.

And when not busy recycling itself, Lucart is raising awareness among local communities to help improve and increase their separate collections of beverage cartons, reducing the energy and processing it takes to separate the cartons at the mill.

The provincial authority for Friesland in the Netherlands is an example of an organisation that has entered into a closed-loop recycling agreement with a paper mill, in this case, Van Houtum. Customers who buy the mill’s Satino Black hygienic paper enter into a contract with their paper collection company to ensure that their paper for recycling is delivered back to them as a raw material, so the process can start all over again.

The European paper industry aims to establish a system for identifying all paper for recycling that is recovered, purchased, received, stored and consumed in European paper mills. To this end, Smurfit Kappa is a leader in this area and has set high targets in ensuring bales are clearly identified, including using adhesive labels on every paper bale (see picture below). The system is working well so far and means that Smurfit Kappa can trace paper for recycling from consumption back to the point of delivery. If quality is found wanting, Smurfit Kappa can identify the supplier and ensure the material is sorted to a higher standard next time.

CEPI initiated this Recovered Paper Identification System. Suppliers can register at www.recoveredpaper-ID.eu

**Examples in action:**

**A new lease of life for a beverage carton**

**Closed-loop partnerships**

**More traceability means better quality = resource efficiency**

**More information at**

www.cepi.org/resourceefficiency
Even the waste from the recycling process has value. The paper industry is looking at more and more ways to stop that waste going to landfill or incineration, by adding value back to the waste, either for papermaking or for other industries.

When paper is recycled, various solid by-streams are formed which contain unwanted materials, or useful materials that are accidentally removed from the production line. These streams are often treated as rejects that need to be disposed of as cheaply as possible. However, these streams may have other potential uses which could generate more value and this is something the paper industry is working on closely.

A WINNING COMBO

Finnish producer UPM has come up with ProFi, a wood-plastic composite which combines the best characteristics of cellulose fibres and plastic. The main ingredients for UPM ProFi are recycled paper and plastic that are left over from UPM's self-adhesive label stock production. UPM ProFi is a material, which can be disposed of through incineration or recycled back into the production process to continue the loop.

NEW LIFE FOR SLUDGE

At SCA's Lilla Edet mill in western Sweden, ash from the sludge-burning process is being used as a construction material for forest roads, as a binder in asphalt, and to raise the pH of farm soil.

RISING FROM THE ASHES

Metsä Forest in Finland provides fertilization services for forest owners – some 5% of its waste becomes fertiliser. Both lime mud and fibre sludge (left over from the pulp production process) also have great potential in fertilization and soil improvement. The pure wood ash is rich in potassium and phosphorous, making it ideal for returning nutrients back to the soil where the new forests for paper are growing.

In Portugal, residues from the pulp process are also used to for soil restoration. After a long research and development programme lead by the PortucelSoporcel Group, several principles were defined for safe utilisation. For 10 years now residuals are applied to forestry soils under strict rules and permanent monitoring. In the dry southern soils with very low organic matter, this supply of ashes and mud has helped to increase health in oak, pine and eucalyptus forestlands.

BUILDING BLOCKS

At SAPPi's mills, they like to use waste sludge from the production process in applications such as the manufacturing of bricks or cement. The dried residual paper sludge from its waste water remains popular as animal bedding material, particularly for cows in local farms. Farmers say their cows are happier sleeping on this dried waste sludge than with more traditional bedfellows of sawdust and straw. The material keeps the animals cleaner, as it is less sticky. And improved hygiene also means healthier cows, and therefore better quality milk.
**Hundred percent recycling**

While it’s just not possible to recycle 100% of all post-consumer used paper, UPM Raflatac is doing all it can to ensure zero wastage. As well as gathering the recyclable waste from its own mill, it takes the waste from its customers’ mills too. This waste is turned into energy and steam that can be used in electricity production in the company’s power plant in Rauma, Finland. The resultant residual steam heats the rolls of the paper machines, so the mill doesn’t have to rely on fossil fuels. Any surplus is directed to the district heating grid for the city of Rauma.

The idea is zero waste and maximum recycling: By-products generated in Raflatac’s business are used as raw material for the company’s ProFi wood plastic composite, as energy at UPM’s paper mills, or as a raw material for paper. They’re the same by-products that would once have ended up in waste incineration plants or landfill sites. Not anymore.

**Even starch gets a second chance**

New recycling technology means that these days even the starch in paper for recycling can be recovered. This increases the yield of new papers made from old ones, it improves their strength, and eliminates the issues caused by degraded starch in used papers when they’re being made into something new. It also means fewer pollutants in the mill’s effluent.

(Source: Ashland)

**Recycling residues**

There are many different ways to put the by-streams from paper production to good use. They can be used as feedstock in production, converted into energy or energy carriers, or used in their current state. The technologies used also vary from conventional methods such as composting and incineration to highly-innovative technologies such as fermentation to produce bio-chemicals.

Within the mills themselves, by-stream products can become many things, from energy to new feedstock (for low-quality paper grades) and a source of minerals, recycled from sludge ash.

(Source: Maximum value from paper for recycling - Towards a multi-product paper mill, CEPI)

**More information at**

[www.cepi.org/resourceefficiency](http://www.cepi.org/resourceefficiency)
Water has always been a crucial resource in the papermaking process, which is why paper mills are usually located close to important water reservoirs. Over the past two decades, pulp and paper mills have been reducing their intake of freshwater dramatically, by 20% in total volume and by 47% when calculated as a specific value, per cubic metre per tonne of product.

Water consumption in the European paper industry is measured by adding up the water lost through evaporation during the production process as well as secondary waste treatment, water in solid residues and water in the products themselves. Water consumption by the European paper industry in 2012 was 298 million m³, or just 7.7% of the water it took to begin with.

Water use is not the same as water consumption: The forest industry uses large volumes of water, but only a small part of this water is “consumed”. Water bound up in products and waste counts as consumed. The remaining process water can be reused (more than 90%).

It is important to remember the distinction between use and consumption when discussing water issues and the forest industry. Water is, however, a local issue and has to be regarded from a water catchment perspective.

A GROUND-BREAKING DISCOVERY:
Deep Eutectic Solvents

Some highly significant research and development within the industry has recently led to an exciting discovery that might eliminate the need for water in the papermaking process altogether. Deep eutectic solvents (DES), produced by plants, could open the way to producing pulp at low temperatures and at atmospheric pressure requiring a lot less energy and no water. Using DES, any type of biomass could be dissolved into lignin, cellulose and hemicellulose with minimal energy, emissions and residues. They could also be used to recover cellulose from waste.

Pure genius

In 2013 Borregaard commissioned a new biological purification plant which significantly reduces the mill’s emissions to water – and more. It also produces green energy in the form of bio-gas which replaces fossil fuel in part of the mill. This in turn will cut CO₂ emissions by 8,000 tonnes in 2014.

Recycled water as well as paper

Holmen Paper Madrid uses treated wastewater in its production process, which comes from a municipal waste treatment plant. Since September 2013, the municipal plant has been delivering high quality treated water to the mill. This makes the mill the first in Europe to manufacture printing paper using 100 per cent recovered paper and 100 per cent recovered water.
Algae-bacteria breathes new life into wastewater

The idea of using symbiotic algae-bacteria biomass to treat wastewater isn’t new, but it’s been attracting renewed interest in recent years. The ALBAQUA project, completed at the end of 2011, showed that it has a future. As the technology gets rolled out, it is expected to have an impact not just for the paper industry, but for many others. Benefits could include added value from the sale of excess sludge as raw material for biofuels or anaerobic digestion and reduced discharge costs due to improved effluent quality.

(Source: PTS)

Bio-gas within hours

At Saica paper mill in Spain, high-capacity anaerobic reactors from Voith Paper can transform organic materials into bio-gas within a few hours. This gas can then be used as an additional energy source for steam or power generation back in the mill.

More information at

www.cepi.org/resourceefficiency
Energy efficiency:
An industry lighting the way

For some years now, Europe’s pulp and paper industry has been working hard to improve its energy efficiency with notable results. Investments in combined heat and power (CHP) generation mean that European pulp mills now produce 50% more energy than they use, a valuable bioenergy resource which gets sold to the local community. CO₂ emissions have fallen significantly – specific emission of CO₂ per tonne of paper produced has fallen by more than 40% since 1990.

In CEPI’s 2050 Roadmap, the target is to reduce the industry’s CO₂ emissions by 80% by 2050. The Two Team Project has delivered several mind-blowing ideas on how to achieve this while adding 50% more value to the industry. These concepts are now being pursued by several consortia with a view to turning ideas into demonstration plants in the future and to reduce the sector’s emissions further still.

Energy efficiency in action

Thanks to the Dalkia CHP biomass plant located at Smurfit Kappa’s Cellulose du Pin pulp and paper mill in France, over 90% of the mill’s electricity and all steam is generated from biomass, which means emissions are drastically reduced. The Dalkia biomass plant is home to the largest biomass boiler used for energy production in France. Bark and sludge, both by-products of the pulp and paper mill, are combusted, while sister company Comptoir du Pin provides fuelwood from forest residues. In fact, with a power capacity of 124 MW, it is among the biggest in Central Europe. The CHP plant produces 50 MW of electricity for the national grid and 74 MW of process steam for Smurfit Kappa’s paper mill. A second turbine (21 MW) gets the steam it needs from Smurfit Kappa’s recovery boiler, and the black liquor produced in the pulping process is used in the power boiler.

Partnerships through the chain

Swedish forest products company SCA and Sundsvall Energi have taken their energy partnership to the next level. With new investment, the joint delivery capacity of district heating from the industrial plants in the Sundsvall region has been expanded to 400 GWh. Two thirds of the increase comes from two boilers at the Ortviken paper mill, which have been converted so they use wood pellets instead of oil. The remaining third comes from deliveries of recovered heat from the Östrand pulp plant. Since SCA’s mills are supplying so much energy, Sundsvall municipality no longer needs to spend €100 million on a new boiler for biofuels. Great news for the local economy as well as the environment.
Fossil-fuel free pulp from Finland...

The Joutseno pulp mill in Finland no longer needs any fossil fuels to run its day-to-day operations, thanks to a large investment in biofuel generation which means it no longer needs oil and natural gas. Instead of fossil fuels, the mill has a new gasification plant which uses bark to produce bioenergy. Over half of the bark comes from the mill itself as a by-product from the pulp process. A large energy consumer in the pulp mill is the lime kiln, which is part of the process for recovering chemicals. At Joutseno, the lime kiln now runs on bio-gas rather than natural gas, and that represents big savings and energy and environmental efficiency.

...and paper from the UK

Iggesund’s Workington Mill in the UK runs entirely on renewable energy, thanks to a new biomass boiler installed in 2013. Workington is powered by biomass such as willow, forest residues and sawmill by-products. The investment has reduced the plant’s fossil fuel emissions from close to 200,000 tonnes per year to zero.

Less is more

LC Paper in Spain has been working hard to engineer a tissue paper production process which uses exceptionally little energy and water compared to traditional grades. Called the OnePly® tissue paper, the product is a mono-layer (as opposed to a multi-layer tissue) which reduces the need for raw materials, energy and water.

Partnering with the local community

Alto Garda Power, which belongs to Italian papermaker Cartiere del Garda and Alto Garda Servizi, installed a combined heat and power (CHP) plant to meet the paper makers’ steam and power needs and Alto Garda Servizi’s hot water needs for district heating in the town of Riva del Garda. The new plant replaced a thermo-electrical power station which served just the steam and power needs of the paper mill. Now, with the new CHP plant, more than 250 large consumers (large residential buildings, hotels, public swimming pool, etc.) get their heating pumped as a by-product of the mill in the form of recovered process steam.

More information at www.cepi.org/resourceefficiency
Few materials can compare to paper. It’s simply an amazing product. Look around you; paper is used everywhere in one form or another. Even better, paper boasts exceptional environmental credentials: it is biodegradable, recyclable, it comes from an infinitely-renewable resource and it is produced in a sustainable way. The future of paper products and applications is changing every day to meet new challenges and provide new, sustainable solutions for society’s needs. Here are a few examples of how resource efficiency can lead to new products and by-products of the papermaking process. There are many others.

**Micro Fibrillated Cellulose**

Stora Enso’s Imatra Mills in Finland is testing microfibrillated cellulose (MFC). This allows for the creation of lighter and stronger renewable packaging materials, while keeping and/or enhancing current packaging properties. In the future, MFC could also replace some of the less sustainable barrier materials currently used in packaging boards, as well as fossil-based materials such as plastics.

**Dissolving pulp**

Stora Enso’s Enocell Mill in Finland produces dissolving birch pulp for the textile industry. Dissolving pulp is well known in the textile industry today, but it can be used for a huge range of applications, from home furnishings to clothes, tyres, paints, cosmetics or even food and medicine.

**Bio-materials**

Finnish pulp and papermaker UPM has teamed up with Helsinki Metropolia University of Applied Sciences to produce the Biofore Concept Car. This unique concept demonstrates the use of renewable bio-materials in the automotive industry. Various parts of the car are made from UPM’s bio-based materials – the UPM Formi biocomposite and UPM Grada thermo-formable wood material. They improve significantly the overall environmental performance of the car, without compromising quality or safety. The concept car is fuelled by UPM BioVerno, a wood-based renewable diesel. And their label materials were used to mark spare parts as well as in the interior and exterior design of the car.
**Tall Oil**

Pulp production also generates tall oil, a very useful bonus. Depending on how it is reprocessed, tall oil can be used in a variety of ways from energy to hydraulic fluids, asphalt, paints, adhesives, and detergents, cosmetics and biodiesel.  
(Source: Metsä)

**Microflutes**

Microflutes are a lightweight but durable corrugated board. Because it’s thin, microflute board saves space during transportation and storage, leading to a reduction in costs and the energy needed to store and transport. Because it’s strong, microflute board doesn’t need any transit packaging, minimising materials as well as costs and environmental impact.

**Stretching the Limits**

At Swedish research company Innventia, a new project is examining how paper can be made extremely stretchable, a quality that will make it possible to replace some of today’s plastic 3D packages, thereby reducing the amount of non-biodegradable plastic waste.

**Office Papers Made Lighter**

A very clear sustainable consumption solution for standard office papers is to choose lower weights. Portuguese papermaker grupo Portucel Soporcel has been making 75-gramme paper as an alternative to heavier standard weights (80g per square metre) for some time, embracing the challenges of eco-efficiency. A 75-gramme paper produces less post-consumer waste, but there are still 500 sheets in a pack. By reducing the weight of the paper by 5 grammes, resources are used more efficiently and the same number of reams can be produced with fewer raw materials. This lighter paper is growing in popularity – proof that resource efficiency is a growing business.

**Lighter Weight Cartonboard**

There has been a trend in recent years towards developing lighter-weight packaging grades to minimise the use of resources and the expense of transporting and storing them, as well as reducing post-consumer waste. Metsä Board has pioneered lightweighting – achieving excellent strength and printability at low basis weights. The company has reduced the weight of its board grades by 13.5% since the 1980s, representing a considerable saving of resources. And it has done it while maintaining all the qualities needed in a good-quality packaging board.

**More Information at**

[www.cepi.org/resourceefficiency](http://www.cepi.org/resourceefficiency)
Industrial Symbiosis: A win-win solution

When different organisations get together in a network to foster eco-innovation and long-term culture change, it’s called industrial symbiosis. Creating and sharing knowledge through these networks means different parts of the supply chain can share their expertise and together create new solutions for the future which they might not have thought up on their own.

The companies involved may be close together physically or metaphorically, or they may not, producing the same things or completely different ones, and the resources they share may consist of materials, energy or water.

It used to be thought that for industrial symbiosis to work effectively, the companies involved had to be close. Thinking has changed. Although it may not be the best environmental option to transport low value/grade materials over large distances, sharing knowledge and expertise has no such restrictions.

What all synergies have in common is that they reduce costs and generate new sales for the companies involved, as well as creating significant environmental benefits such as reduced landfill and greenhouse gases. In addition, the synergies generated through economic activity have further social benefits with the creation of new businesses and jobs.

A great example is the increased cooperation between a paper producer and the textile and/or cement industries it may supply with direct or by-products, as well as an on-site energy supplier, or a food processor supplying agricultural waste for recycled papers.

Synergies that work

More than 10 years ago a community began to form around Biocel Paskov made up of wood-processing companies which have different owners but are interconnected. Biocel Paskov, a member of the Lenzing group since 2010, makes dissolving pulp for viscose fibre. In 2004 Mayr-Melnhof completed a large sawmill adjacent to Biocel, which supplies wood chips to the Biocel pulp mill. Near the sawmill is a wooden pallet plant, as well as a pellet plant. (Pellets are made from sawdust and shavings, by-products from the sawmill.) Close by, another mill produces substrates. A community of wood-processing companies is a good example of how wood raw material can be used in one locality with minimal transport costs and mutual synergies.
Papeteries du Rhin:
Best of both worlds

A great example of partnership between the public and private sector in the form of a papermaker and the local community can be found in Mulhouse, France. Mulhouse has a municipal waste incineration plant operated by SITA which produces electricity.

Papeteries du Rhin owned by the Kunert Group makes core board and generates steam from a natural gas boiler. The mill sends its effluent to the municipal water treatment plant and its sludge is burnt in the municipal incineration plant. But from 2015, the municipal waste incineration plant will also provide steam energy to the paper mill. A giant pipe from the incinerator to the paper mill will pump more than 80% of the mill’s annual steam needs. The mill’s gas boiler will remain only to provide the necessary additional steam during peak consumption periods and during incinerator maintenance periods.

This district heating network will double the energy efficiency at the waste incineration and slash CO₂ emissions at the paper mill by 70%.

Co-financed by Papeteries du Rhin and ADEME (French Environment and Energy Management Agency), the project will cost about three million euros. It’s a prime example of what can be achieved for the environment when public and paper sectors work together.

Closing the loop with consumers

In cooperation with one of its customers, Smurfit Kappa Roermond Papier has started a project to recycle phosphorus. Its partner makes baby nutrition products and has no use for phosphorus which is harmful for infants. So instead of disposing of any phosphorus removed during its processing operations, the company’s waste stream is directed to the paper mill’s water treatment plant to use as feed for bacteria, producing biogas. It saves Smurfit Kappa Roermond Papier money (because it no longer needs to buy in phosphorus) and it avoids disposal and its impacts for the baby nutrition producer.

It all adds up to a great example of a partnership that contributes to both the environment and the economy.

More information at

www.cepi.org/resourceefficiency
We know that the world’s growing population is putting increasing pressure on global resources and that the world’s current consumption patterns are simply not sustainable in the longer term. As the world’s finite supply of fossil fuels diminishes, in direct contrast to the increasing demands of a larger population, we will need to move to a circular economy based on renewable resources and optimum efficiency. In contrast to the linear model of take, make, dispose, a circular economy is a framework that takes insights from living systems. It considers that our systems should work like organisms, processing nutrients that can be fed back into the cycle, whether biological or technical, which is where phrases such as “closed loop” or “regenerative” come in.

It’s also why we believe Europe’s paper industry has a very bright future – because it is already a benchmark model of resource efficiency and a perfect fit for the circular economy. It is inherently sustainable by nature: Based on renewable, recyclable raw materials, Europe’s paper industry can produce second-generation biofuels to replace crude oil as well as renewable bio-based products. It provides packaging solutions to avoid food waste and it uses residues from the woodworking industry as its raw materials. These are just a few examples, you’ll find many more in the pages provided in this folder.

At the core of the bioeconomy

The European paper industry is at the core of the bio-based economy because everything it produces comes from forest fibres, a primary, renewable resource. It takes all the components in wood and transforms them into value-added bio-based products. And that doesn’t just mean pulp and paper: Through the biorefinery concept, a paper mill is much more than the sum of its parts, making a vast range of innovative products. While wood fibre is used to make pulp, resins can be turned into chemicals and bark into renewable energy. Excess electricity is often sold to the grid or process steam pumped to heat nearby homes. By getting the most that it can from its production process based on renewable resources, Europe’s paper industry provides the ideal path from a fossil-based to a bioeconomy.

Living the circular economy

Once the paper has served its purpose, the industry recycles that paper to make something new, which makes a lot more sense than burning it or sending it to landfill as waste. Along the way, it creates additional products from the residues of the recycling process, adding value and innovation. Old paper cannot be recycled indefinitely – it needs an influx of new wood fibres to keep going otherwise the fibres wouldn’t be strong enough to make new products. Those new fibres come from renewable, sustainably-managed forests, continuing the loop.

The story

Resource efficiency in practice

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