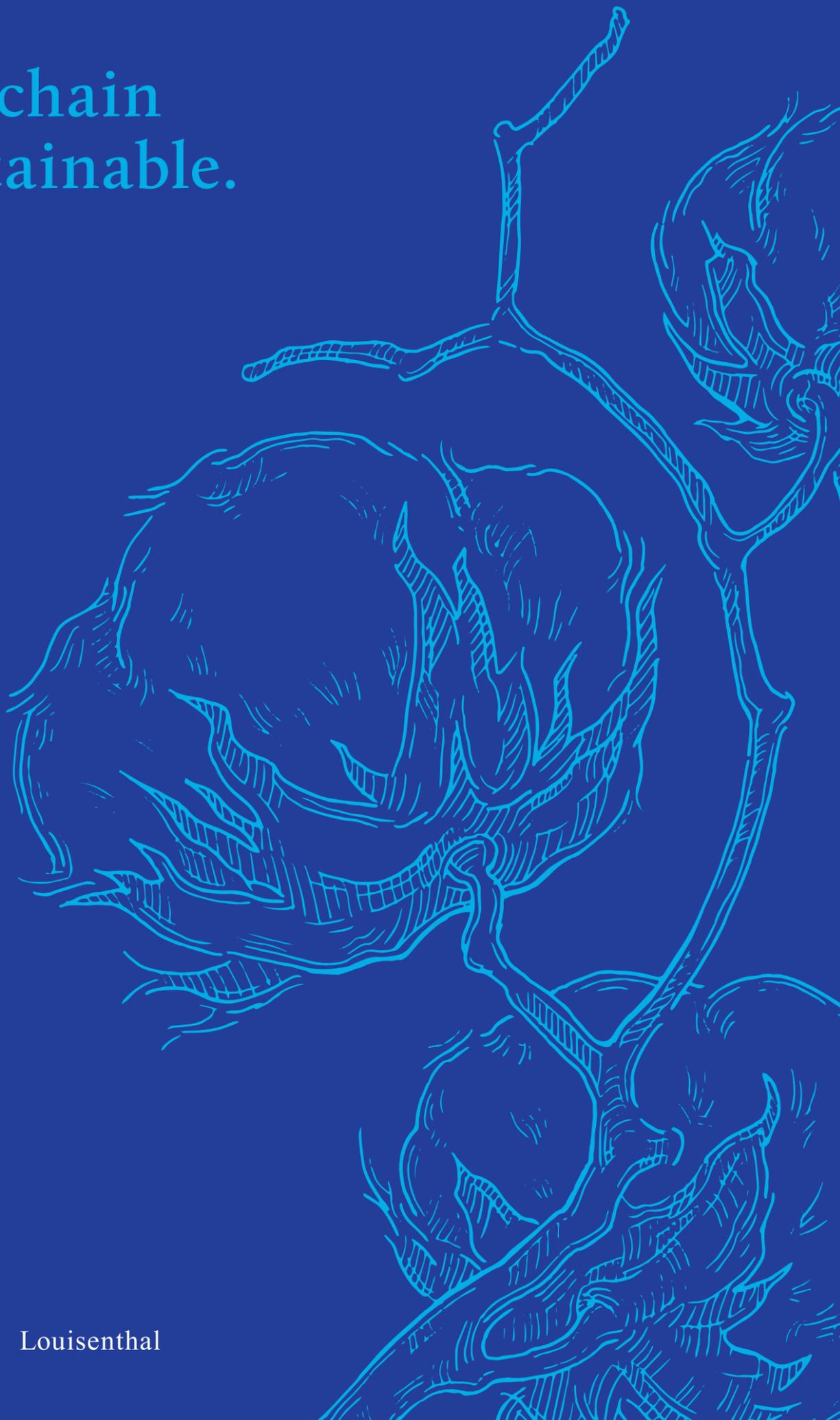


The life of a banknote

How a value chain
becomes sustainable.



G+D
Currency Technology



Louisenthal

**Does m
need a
ethics?**

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new

Wouldn't it be great if every question in life had a simple answer? For instance, what are good banknotes made of, cotton or polymers? Or is a mix of the two even better? If there's one thing that we've learned from our search for a sustainable banknote, it's that the answers are rarely a straight yes or no. They almost always come with an if or a but attached.

Yes, cotton is a renewable resource – but it needs to be produced sustainably and fairly. No, most of the polymers used are not biodegradable – but even an extremely thin foil can make banknotes last three to four times as long. Hydroelectric power is good – as long as you treat the source with care.

Where do you start when you want to make major changes? We took a long, hard look at our entire value chain and carried out an honest appraisal: What is going well? Where could we do even better? On the following pages we tell you what we found, and what we plan to do about it. What happens after that depends partly on you – on the common goals that we formulate and put into practice going forward.

**Fifty
shades
of green.**



Another job for the king of multitasking.

Can you make banknotes more sustainable?

If ever there was a Swiss Army knife of the paper industry, it's the banknote. Not only do banknotes have to be able to do everything and withstand almost anything that's thrown at them, they also have to look good. That rather limits the conversation around sustainability. Banknotes have up to 20 security features that must be visible to the naked eye or to banknote processing systems, and incorporating them takes a lot of energy. On top of that, banknotes have to survive being folded and refolded hundreds of times – which is why we cover them in a thin hybrid foil.

Sustainable banknotes? There's not much room for maneuver, but action is possible in areas such as clean energy, "fair" cotton, reusable packaging, recycling. What are we already getting right and where can we do even better? Join us on a tour of our value chain.

Security



Security features need to be highly sophisticated – so sophisticated, in fact, that no technology in the world can reproduce them. But at the same time you need to be able to check that the banknote is not counterfeit within seconds, either with the naked eye, by checking for watermarks and dynamic or color effects, or mechanically, using sensors.

Design



The design should represent the issuing country and at the same time make the banknote attractive. It also has to meet strict technical requirements. For example, the main motif should not be placed in the middle, otherwise it is distorted when the banknote is folded in two. And the security thread and foil must be integrated in such a way that the banknote is easy to handle when in use.

Durability



Money needs to be clean and durable. Different denominations of banknotes have different circulation rates and have to be more or less durable accordingly. For high-value "saving" notes, pure cotton is the right material. Low-value "market" notes, which pass through many hands, need more protection – for example, a thin foil layer (Hybrid™ or Hybrid ADDvance®) on each side.

Clartext
for checking
authenticity by eye

Security thread
for checking
authenticity by eye

Fluorescent ink
for checking authenticity
using UV light

Watermark
with e-type
for checking
authenticity by eye

Design concept
Attractive and
functional

Secure window
for checking
authenticity by eye

Magnetic print
for checking
authenticity
by machine



Infrared ink
for checking authenticity
by machine

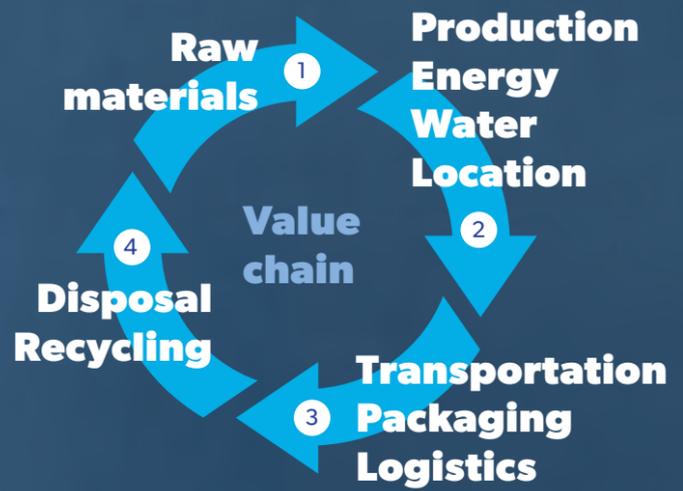
Iridium printing
Copy protection

Magnetic code
for checking authenticity
by machine

Security fibers
Fluorescent or visible
in daylight

Cotton core
between protective foils
for a longer lifespan

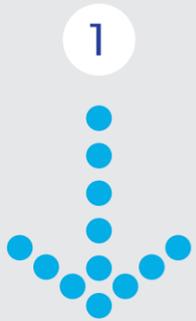
Features for the
visually impaired
Tactile pattern



— Security features used in this sample note
..... Optional security features

**Does money
need to be
certified
organic?**

RAW MATERIALS



Cotton

A valuable fiber.

Where our cotton comes from.

The core of our banknote substrates is cotton noils, which we purchase mainly from spinning mills in Asia and southern European countries via intermediaries, not directly from the growers. The cotton does not necessarily come from the country where the mills are located. To determine the exact origin, we can ask the intermediary.



Cotton

Soft to the touch. Hard to get.

Cotton

One man's trash...

How organic and fair is our cotton?

Anyone who's ever tried to buy a really good shirt knows only too well that sustainably, fairly produced cotton is hard to find. Cultivation requires a lot of water, seeds are often genetically modified, plants treated with pesticides. Not only that, many plantation workers operate in difficult, unhealthy conditions and are often not paid fair wages. To produce our banknotes we almost exclusively use a waste product from the textile industry, which accounts for just 0.375 percent of the world's raw cotton. Moreover, we use the part of the harvest that can't be used for producing high-quality fashion. Does that put us completely in the clear? No. We believe that we can do better even with relatively small improvements. That's why we are committed to using fair, certified organic cotton waste in our banknotes, despite a highly competitive market. Supply is very limited and often the goods only partially meet our required standards – they are organic, for example, but not fairly produced. We are not able to check that what the labels promise is really true. In addition, the raw material must meet our quality criteria with regard to the length and thickness of fibers, the amount of foreign matter contained within, the level of micronaire and the absence of fluorescence.

As we only purchase a waste product, we have no influence over the quantity or quality of cotton on the market. Nevertheless, you can read about how we hope to promote the cultivation of cotton that is in harmony with man and nature and humanity under "Our ambitions".

Cotton

... another man's treasure.

Turning trash into cash.

Did you know that we use a waste product from the textile industry to make our banknote substrates? The textile industry mainly uses long cotton fibers, while the short ones, known as "noils", are used to make cotton wool pads, cotton buds and – you guessed it – banknotes.

Cotton

Green like cotton.

100 %

Where there's a will, there's a way. DNB (De Nederlandsche Bank) sent out a very positive signal by asking us to produce banknotes made out of 100 percent organic, Fairtrade-certified cotton by 2019. That means no chemical pesticides or fertilizers and a minimum price for producers that covers their costs, plus a premium for community-based projects.



Alternative fibers

Plant-based possibilities?

All cotton – or not?

Really good, organic, Fairtrade cotton is hard to come by. So, why not just switch to another raw material? It's not that easy, as we found out. Cotton has been used as a substrate for banknotes for centuries, and has come to mean something over and above its actual material value in some countries. In addition, it's a real all-rounder: It can survive washing machines and irons, and is difficult to tear. Studies of flax, hemp and polyamide fibers show that there is no substitute

that is able to compete with cotton in every category.

Maybe the solution is to combine cotton with something else. Louisenthal has come up with Synthec[®], a product that is much far more tear-resistant and therefore more durable thanks to the addition of a few synthetic fibers. Research is currently underway into how to harvest these fibers from recycled plastic, such as shredded PET bottles.

Despite this, we remain open to experimenting with plant-based alternatives and are happy to respond to input from our customers. The new Philippine peso, for example, is 80 percent cotton and 20 percent local abacá banana hemp, which is also used to make tea bags, cigarette paper, sausage casings and industrial filters. It's also possible to experiment with fibers from Europe, such as replacing some of the cotton noils with hemp.



Chemicals

No more crumble in the tumble.

Why we are proud of our wet strength agent.

It's easily done: You stick a fiver in your jeans pocket and then later on stick your jeans in the washing machine. To make sure that the banknote doesn't fall apart in the wash, we mix a "wet strength agent" into the cotton substrate. We use a third-generation agent, the best and the cleanest on the market. In fact, we have little choice in the matter given the location of our plant within the catchment area for drinking water for the city of Munich, where the threshold values are particularly low. To ensure that the agent meets

our requirements, we have developed together with our suppliers an improved, even purer product – which, of course, is that little bit more expensive.



Plastic

As much as necessary. As little as possible.

Our use of plastic as a raw material.

We use plastic for the security features on our banknotes and also to increase the lifespan of the notes. It is found in the security threads and the ultrathin foil that encases the cotton core (Hybrid[™], Hybrid ADDvance[®]), protecting the banknote from dirt and moisture. We buy the foil from manufacturers in Europe – where they melt down polyester flakes and then stretch them into foil. All petroleum-based plastics have limited availability and resist degradation. So we've established a simple rule for our use of them: As much as necessary. As little as possible.

As much as necessary for the banknote to have as long a lifespan as possible. Because nothing is as energy-intensive as a banknote that constantly has to be disposed of and then reproduced. And as much as necessary in order to ensure that the banknote can't be counterfeited. As a rule of thumb, lower denominations need to be particularly resilient as they pass through a lot of hands, but they don't necessarily need the full battery of security features. With high-denomination banknotes it's the other way around: They don't need to be as tough as their circulation rate is lower, but they need more security features. That's why we use the thinnest foil that can be processed mechanically, and around eight times as much cotton as foil.



6 μm

We use the thinnest foil that can be processed mechanically, just as thick as a fifth of a human hair.

Beliefs and goals

Our ambitions:

We are increasing the proportion of organic and Fairtrade cotton used in our products.

We strive to ensure that sustainable cotton is increasingly included in the specifications for tenders.

We promote the processing of more readily available and sustainable fibers as alternatives to cotton.

We are always willing to test out new fibers, especially if it will increase the local value add of smallholder farms in a specific country.

We aim to support research into bioplastics.

We are considering using funds from our R&D budget for research and development into biopolymers.

Worth knowing

Did you know ...

... that producing new Bitcoins not only consumes a lot of energy but also releases a large amount of CO₂?

It's easy to assume that digital currencies are environmentally friendly. They don't use cotton or plastic, true. But what they do use is a lot of computing power. And most of the servers in the Bitcoin network involved in "mining" new Bitcoins are located in regions that rely heavily on fossil fuels for electricity – almost 50 percent of them in China, it is thought. Only two percent or so of new Bitcoins are produced in Iceland, which uses exclusively renewable energy. The average amount of CO₂ (or equivalent) emitted by Bitcoin factories globally is 475 grams per kilowatt-hour. That's roughly the same level found in the electricity mix in Germany, which still uses a lot of coal, but nine times more than France and 43 times more than Norway!

Source:
<https://digiconomist.net>;
<https://www.carbonfootprint.com>



Waste not, want not

We don't use raw cotton to produce our banknotes, we use cotton fibers or "noils" that are usually too short for the production of textiles. In other words, a waste product from the fashion industry.



With a great location ...

... comes great responsibility. A factory producing banknotes located in the drinking water catchment area of a megacity? That's certainly a challenge. But it also ensures that we put sustainability into practice. The 55-hectare forest around the factory also belongs to us, and stores more than 300,000 tons of CO₂.

PRODUCTION ENERGY WATER LOCATION

2



Louisenthal

The worst location – or the best?

A unique advantage: Within the drinking water catchment area for Munich.

There has been a paper factory in Louisenthal since 1880, originally producing regular paper. Today, no one would dream of building a factory here in the middle of the drinking water catchment area for Munich. But we like to think of our location as an advantage. It meant that, right from the word go, we had to include environmental protection and sustainability in our processes. We are also subject to strict European environmental protection regulations and are doing our bit to support the turnaround in the change in German energy policy. When it comes to controlling water pollution too, we follow probably the strictest rules in the world. These are challenges that we are glad to accept – indeed, we often go beyond what is required by law.



Go with the flow

The river Mangfall is one of our hardest-working employees. We use it to produce paper, cool our buildings and machines, and even generate our own electricity. So naturally we take good care of it, too.



Energy

Big requirements, big savings.

We invest in less.

There's no hiding the fact that producing banknote substrates and security foils uses a lot of electricity, heat and water. At the Louisenthal site we consume as much electricity as 16,000 single-family homes. But that also means that there are lots of potential savings can to be made. Indeed, over the last decade and a half we have already spent EUR 15 million on sustainability projects and we have no plans to let up in the future.

less water used than in 2010 – with the help of our wastewater treatment plant

40 %



homemade electricity from hydropower and combined heat and power generation

24 %



1.5 GWh



saved each year thanks to our cooling system – enough to run a standard refrigerator for up to 8,000 years.

Electricity

Homemade energy.

How we save electricity – and generate our own.

We generate almost 25 percent of our electricity locally and in a CO₂-neutral fashion. For this we use three water turbines, the latest of which was modernized as recently as 2014 and has a sensor-controlled, fully automatic water inlet that only takes as much water from the river Mangfall as it actually needs. We also have a combined heat and power system in the boiler house that burns gas to generate heat for our paper mill, and at the same time – almost as a side effect – generates electricity. On average we generate 10 gigawatt hours of electricity a year.

Water

A liquid diamond.

For us, water is the most important element.

We use it to generate electricity, to cool the mill, and in large quantities for the production of the paper itself. Our location within the drinking water catchment area for Munich means that we have to be particularly careful about how we treat this vital resource. In 2010 we installed a biological wastewater treatment plant in which bacteria are used to purify the process water. The bacteria are then separated and recycled using a membrane filtration system and the purified water is reused in production. This has enabled us to reduce our water consumption for production by 40 percent, from 1,600 m³ a day to 900 m³. Since 2017 we have also been voluntarily leaving more water in the river Mangfall than we are required to by law: 1,000 l/s rather than the previous 350 l/s. Last but not least, we have installed two fish ladders in recent years so that fish can bypass our weirs and populate the Mangfall more easily than in the past.

Heat and cold

Using what's already there.

An efficient, sustainable approach to heating and cooling.

Producing paper requires not only electricity but also heat. We generate both locally in our steam power plant by burning natural gas. We replaced our gas burner as recently as 2018, and its CO₂ and nitrogen emissions are far below not just the levels required by the current Federal Immission Control Act (BImSchG) but also by the new, stricter version that is due to come in soon. And thanks to combined heat and power generation, we generate electricity at the same time (see above). If you use a lot of heat, you also need a lot of cooling. To make sure that our paper retains the right properties, we climate control our production rooms all year round. From November to April, we do this passively using water from the Mangfall. That has meant savings of around 1.5 gigawatt hours of electricity a year since 2009, the equivalent of some 600 tons of CO₂. In the very cold months we have to heat the rooms, which we do using waste heat from the production process. That has saved another 2,000 metric tons of CO₂ equivalent a year since 2013.

**How do
do we
money**

ean

want

to be?

Hazardous materials

Step by step. Substance for substance.

Sadly, we don't just use power and water. To make paper you also need materials that pollute the environment and which, if handled incorrectly, could endanger the health of your employees. We do everything we can to minimize our use of these hazardous materials, going far beyond what is required by law.

Like all companies in the European Union that use hazardous materials, we regularly subject them to a "substitution test". If we find that less hazardous alternatives exist, we replace them. Here are a few examples.

Hazardous materials

Replacement is king.

We were able to replace a harmful substance.

The paper machine previously used a substance for surface coating that can harm fertility (a CMR substance). We searched for an alternative and are now using a substance that does not require labeling. As a result our entire paper-production process is now CMR-free.

Hazardous materials

Less is more.

One less substance hazardous to health.

We have also just banned another hazardous substance from our steam power plant. In the past we used hydrazine to protect against corrosion, which is potentially carcinogenic. In April 2019 we were able to stop using it completely due to changes introduced at the plant.

Hazardous materials

Cleaning cleaner.

A more sustainable way to wash your hands.

Sustainability is also important at the micro level. We recently replaced the soap used by production staff to wash their hands. The new soap contains environmentally friendly corn flour rather than the microplastics that pollute rivers and oceans.



Out of the water!

This is what metallization residues from foil production look like after they have been separated from the washing water by a filter system.

Waste prevention

Waste matters.

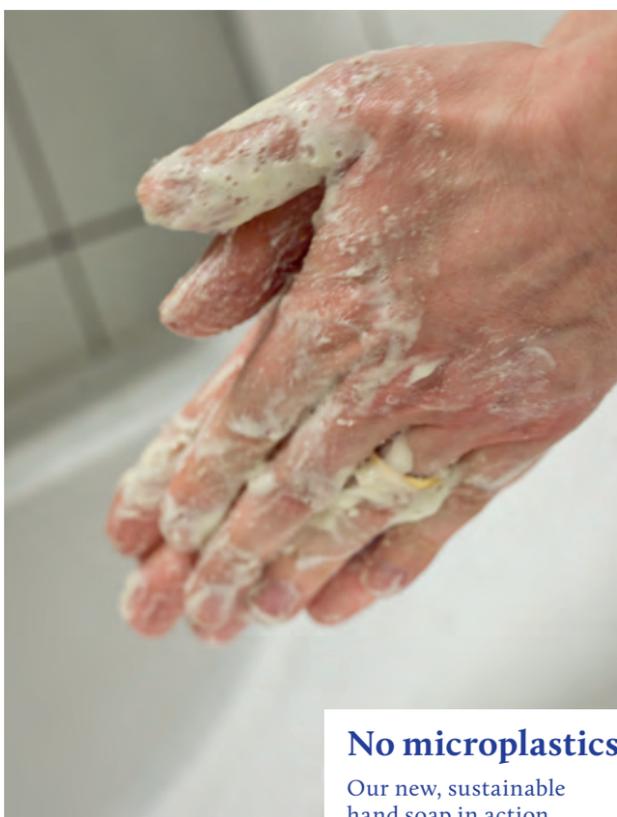
Sustainability also means thinking about waste – how to avoid it and how to use it productively.

For example, our biomembrane reactor enables us to use water several times over during the paper production process, saving 700 liters of wastewater a day.

Producing foil also creates wastewater, some of which is contaminated with heavy metals from the ink used in the foil. Before this wastewater is discharged into the municipal wastewater treatment plant, it passes through our on-site water purification process where harmful substances are filtered out (see picture above).

The solvent-containing exhaust air from foil production is also completely burned off in our regenerative exhaust air cleaning system. The heat generated in the process is used for drying printing inks and heating the production halls.

Cleaning our metallization machines produces solids (dusts). These are then used to fill up old mining tunnels.



No microplastics

Our new, sustainable hand soap in action.

Beliefs and goals

Our ambitions:

We are considering using a gas turbine to increase the efficiency of our combined heat and power plant.

We have entered discussions regarding finance for a new gas turbine that would enable us to increase the amount of electricity we produce from combined heat and power generation.

We actively avoid CMR substances throughout the entire production process.

We aim to eliminate all potentially carcinogenic, mutagenic or reprotoxic substances (CMR substances) from production processes in our paper and foil plants. That means avoiding any CMR substances currently known to us. If one of our materials is reclassified as a CMR substance, we will replace it as quickly as possible.

Worth knowing

Did you know ...

... that the digital currency Bitcoin currently uses about as much electricity per year as the whole of Switzerland: 62 terawatt hours?

Granted, the producers and users of digital currencies don't have to worry about steam production, water treatment or replacing hazardous substances, unlike us at Louisenthal. At least as long as you ignore hardware production, without which no data processing is possible. But that doesn't mean that Bitcoin, Ethereum and the like also save electricity. On the contrary, a single Bitcoin transaction requires 471 kilowatt hours of electricity, which is enough to power almost 16 US households for an entire day, or more than 50 German households. That corresponds to a footprint of 222 kg of CO₂ per transaction.

Source:
<https://digieconomist.net/>;
Federal Statistical Office



Free-range fish

Fish can bypass our two weirs via specially designed stairs that allow them to swim up and down the River Mangfall.

**Can a fiver
save the
world?**

TRANSPORTATION PACKAGING LOGISTICS

3



Packaging waste

Sustainability in a box.

From A to B without waste.

After our banknotes have been sorted and checked, they are bundled in wads of a hundred and banded with coated paper for safe transportation. They are then shrink wrapped in foil in batches of ten wads. The result: lots of plastic waste.

As part of our 2017 competition for Best Sustainability Action, our staff came up with the idea of using NotaTracc® Trays for transportation instead. Rather than packing and unpacking the banknotes for transportation, they can be sorted directly into NotaTracc® Tray and sealed securely. We are already using the trays and the sorting of banknotes will be completely automated by 2021. This not only saves us several work steps, it also reduces the amount of packaging material used by 25 percent. Over six years, that means a saving of 483,463 km of coated paper for banding and over 730 tons of shrink foil.

less packaging material by using NotaTracc® Trays for transporting banknotes

25 %

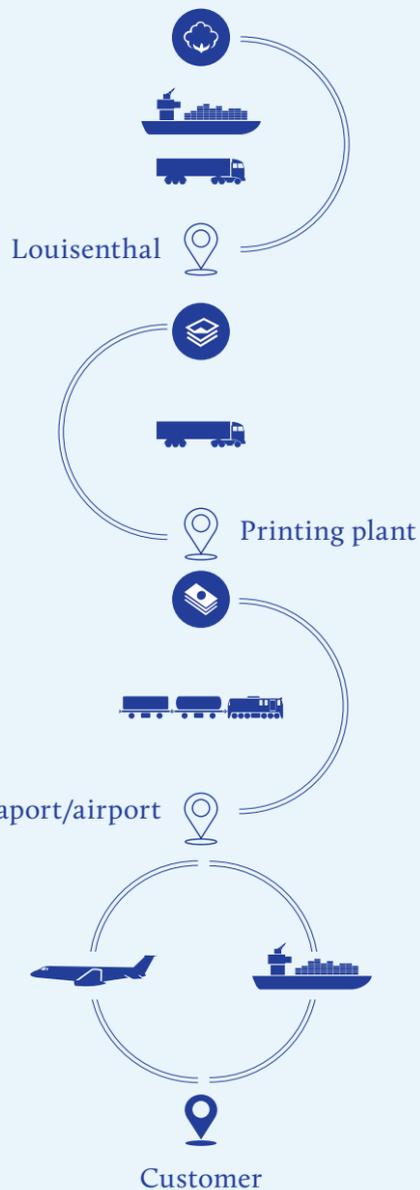


Means of transportation

These streets are made for money.

Can a global product be transported sustainably?

Banknotes don't just move from one till to the next: Many kilometers have to be covered even before production begins. Cotton from India, foils from Frankfurt... And when production is complete, the finished banknotes are shipped all over the world. Until that point, we try to avoid air transportation as it produces 22 times as much CO₂ as going by sea – although international shipping still has a long way to go when it comes to harmful sulfur oxide emissions. When the notes are ready, it is the customer that decides about how to transport them. Often they choose air, as the fastest route. Security can also be guaranteed for sea and rail transportation.



CO₂ balance



Recycling waste

Green as grass.

A pilot project for creative waste recycling.

Can grass and paper be turned into plastic? Yes – so say the staff at our Königsstein plant. They have developed a bioplastic made from shredded scrap paper, grass fibers and recycled plastic granulate. This could be used to produce sustainable cash transportation boxes for G+D cash-sorting machines, for instance. We are currently looking into whether there is a market for the new material.



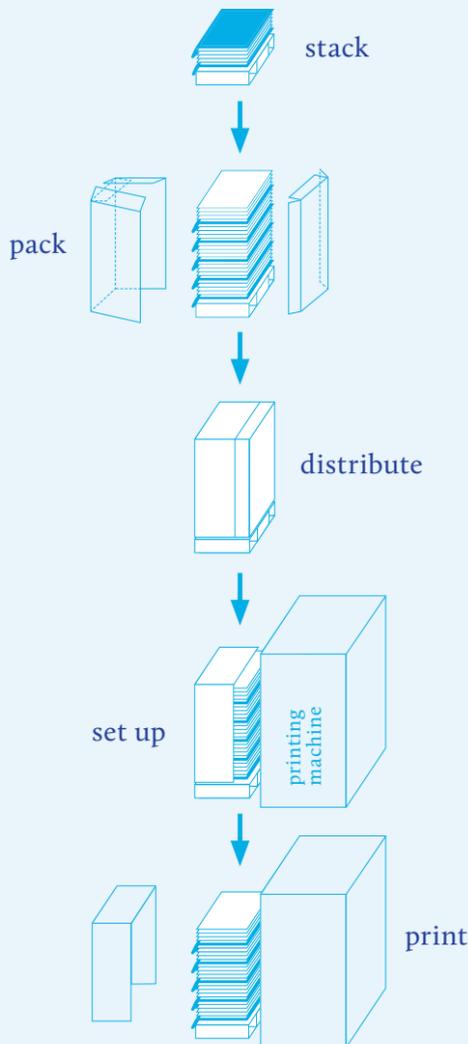
With “Ready2Press”...
... the paper stack is structured so that it can be taken directly to the printing machine after unpacking.

Packaging systems

Ready for less!

How we can save packaging before printing.

Before we send the finished sheets of paper for printing, we currently shrink wrap each ream (500 sheets) upon request. The reams are then stacked on top of each other, each one rotated by 180 degrees. Finally, we put a cardboard box over the whole tower. When the delivery reaches the printers, they remove the reams from the stack one by one, take off the shrink wrap and feed them into the printing machine. It occurred to us that there must be a better way of doing this. So, we developed a new packaging system, called "Ready2Press". Ready2Press not only saves materials, time and effort – it also improves quality and enhances the production process.



Beliefs and goals

Our ambitions:

We are integrating Ready2Press into our production process.

We are preparing the ground by standardizing the current range of different customer-specific packaging types – naturally, in close cooperation with our customers.

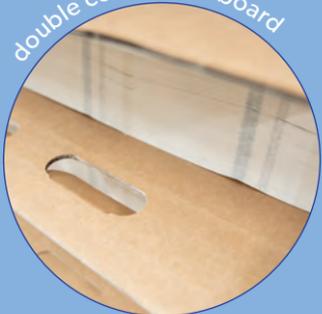
We promote the switch to sustainable transportation routes.

To achieve this we are increasingly busy talking to our customers about more sustainable routes and means of transportation.

We are reducing packaging waste related to production and transportation.

We dedicate part of our research budget to avoiding packaging waste and reusing production process waste.

double corrugated board



base



wedge slats



delivery



Here's how it works.

Our basis is a frame-like structure. This structure can hold 6,000 to 8,000 sheets each so it can be easily transported. In case the stack leans to one side or the other, double corrugated board is inserted next to the sheets. If necessary, the corrugated wedge slats used in the printing process can also be inserted into the stack in such a way as to provide additional stability. We then wrap the entire stack in an outer layer of cardboard with a wafer-thin polyethylene protective coating. That means we don't have to laboriously package the individual reams, and the entire stack is ready for printing immediately after unpacking – it doesn't have to be restacked at the printer's.

To implement the Ready2Press system, a special packaging machine is needed that builds the stacks automatically. We have an initial concept for such a system and can help interested paper mills and printers introduce Ready2Press systematically. In order to be able to integrate the system into our own production process, we are first standardizing the wide range of packaging types that exist at the moment and creating space for the new machinery. As the investment costs are very high, we will only be able to implement the new system if there is sufficient demand.

Worth knowing

Did you know ...

... that Bitcoins are an energy-intensive investment?

Of course, with Bitcoins you don't have to worry about secure transportation: The digital currency does not physically move from place to place. The only risk is from hacking, which can be minimized by following existing security rules correctly.

So, are they a safe investment? Bitcoins are rarely used to pay for anything; indeed, some investors call them "digital gold". Like gold, Bitcoins do not yield interest but have to be "mined" at a relatively high cost. And like gold, of which only a finite amount exists in the world, the total quantity of Bitcoins is also limited. The last Bitcoin will probably be mined in 2140, by when around 21 million Bitcoins will be in existence.

Which investment is more sustainable, Bitcoins or gold? In other words, mining which one uses up more energy? Here, we need to remember that each Bitcoin transaction requires more complex calculations than the one before. As a result, Bitcoins use more and more computing power, more and more electricity, and their CO₂ footprint is constantly growing. With gold, by contrast, the effort involved remains the same. Comparing Bitcoins with gold weight for weight, mining a Bitcoin already consumes 8.5 times as many kilowatt hours of energy and has a CO₂ footprint ten times larger than that of gold. And the levels will inevitably keep on rising.

Source:

<https://www.gevestor.de>;

<https://digiconomist.net>;

<http://www.bitcoin-faq.de>

**What if no
one has ever
been paid
fairly?**

**Money at
all costs?**

DISPOSAL RECYCLING

4



The future

Sustainability never stops.

Sustainability from start to finish.

True sustainability means thinking about the entire lifecycle of a product. Money is no different. What happens to old, unusable banknotes is up to our customers at the end of the day. That's why we've been cautious when talking about this issue so far. But we believe that this is something that we all need to think about more in the future – for the sake of true sustainability.



Disposal

Our small share of a big issue.

Recycling is a global challenge.

Whether they're made of cotton, polymers or a combination of the two, banknotes only account for a very small proportion of the world's waste. German households produced 46 million tons of household waste just in 2016. By contrast, a mere 150,000 tons of banknote substrate are produced each year worldwide – and that only has to be disposed of at the end of its useful life. Be that as it may, this is an issue that we care about deeply.

Recycling

Polymers



Pure polymer banknotes can be recycled into new products, such as flower pots. Often this doesn't happen, however, and the old notes end up in incineration plants or going to landfill.

Recycling

Cotton



Cotton has a particularly good calorific value. The heat energy generated from burning cotton banknotes can be used in a variety of ways, wherever particularly high temperatures are required – in cement production, for example.

Durability

No waste is the best waste.

The longer it lasts, the more sustainable it is.

That's certainly the case for banknotes, at least: The longer they last, the fewer banknotes have to be disposed of. That's why we developed LongLife™ and Hybrid™ banknotes – cotton banknotes coated with a special lacquer or a thin foil layer. It significantly boosts the durability of notes with high circulation rates, without compromising on security. For example, three years ago the Bank of Jamaica changed the material it used for its highest circulation banknote, the Jamaican 100 dollar bill, from pure cotton to a Hybrid™ substrate. Everyday life in Jamaica is very much cash-based and the 100 dollar bill is the most popular banknote. In the past, the 100 dollar bills had to be replaced and disposed of every four months; today, Hybrid™ technology has tripled the lifetime of the banknote to a full year. An even longer lifespan would have been possible with pure polymer banknotes. However, switching to pure polymer would have meant a new design, getting rid of certain security features and converting all the automated processing systems. None of that was necessary with Hybrid™ banknotes, which therefore offered a much better cost-benefit ratio.

3x

as durable
thanks
to Hybrid™

Beliefs and goals

Our ambitions:

We continue to search for even longer lifespan.

For a long time now we have devoted a significant part of our research budget to improving the durability of the banknotes we produce. We are now stepping up these efforts, as longer-lasting notes mean less waste.

We support research into recycling and post-use concepts for banknotes that have been disposed of.

In the future, this will enable us to provide customers with advice about the entire lifecycle of a banknote. To this end we are looking to support credible research teams or partner organizations.

Worth knowing

Did you know ...

... that producing Bitcoins requires special computer hardware that quickly becomes obsolete and ends up as electronic waste?

The blockchain technology behind Bitcoin is based on complicated math, and that math gets more and more complicated from calculation to calculation. This is the way it is designed. But it also means that when you “mine” Bitcoins, you have to use more and more increasingly efficient computer hardware in order to perform the calculations fast enough. In the early years of Bitcoin, regular computer hardware was used; a few years ago, highly specialized chips came in that can only be used with Bitcoins. Every 18 months on average they are replaced by newer, even more efficient chips. And the old ones? They can't be used for other purposes, so they end up as electronic waste.

A single Bitcoin transaction produces almost as much electronic waste as two 60-watt light bulbs – or more than 10,000 credit card transactions.

The chips could be recycled but this is also quite labor-intensive. Worldwide roughly only 20 percent of all electronic waste is recycled. The rest simply ends up in landfills.

Source:
<https://digiconomist.net>



The air is clean!

Our regenerative afterburning system cleans the solvent-containing exhaust air from the production of foils. Thanks to a heat exchanger we can use the waste heat to dry printing inks and heat our production buildings.

As green as money can be. *Tomorrow's banknotes.*

It could work! We are optimistic: Our ambitions are challenging but feasible. Especially if we take our clients with us on this journey, and they themselves start demanding greener banknotes.

Why not specifically include the goal of sustainability in public tenders, say? The more prominence we give this issue, the faster we can turn "green banknotes" into reality.

We plan to show just how serious we are at the next industry summit in 2021. By then, we aim to present a new banknote as part of a concept study developed in line with industry standards. Our objective? To create the most sustainable banknote in the world.

Here's how it could work:

1. Fibers

- 80 percent fairly traded organic cotton residues
- 20 percent alternative renewable fibers
- > **Goal: Substrate made from 100 percent locally sourced fibers**

2. Other raw materials

- Plastics from renewable raw materials
- Highly pure third-generation wet strength agent
- > **Goal: A biopolymer protective layer**

3. Energy

- Production uses more than 25 percent homemade electricity from hydropower and combined heat and power generation
- Paper pulp dried with heat from our own steam power plant
- Production rooms climate-controlled using river water and waste heat from production
- > **Goal: 100 percent renewable energy in production**

4. Recycling

- > **Goal: Old banknotes 100 percent recycled or subject to thermal recovery**

5. Transportation

- > **Goal: Use the most sustainable means of transportation possible**

6. Packaging

- Plastic-free packaging – reusable transportation boxes
- Printing with minimum packaging thanks to Ready2Press (see pp. 20/21)
- > **Goal: Transportation boxes made from waste products and grass fibers**

7. Production

- Materials that are harmful for humans or the environment substituted
- Waste water from the production of foil treated on site
- Foils dried with heat from burning solvents
- > **Goal: Completely CO₂-neutral production**

8. Water

- Production within Munich's drinking water catchment area subject to strict conditions
- Production water treated using a biomembrane reactor
- > **Goal: A largely closed water cycle in the production process, with as little fresh water introduced as possible**

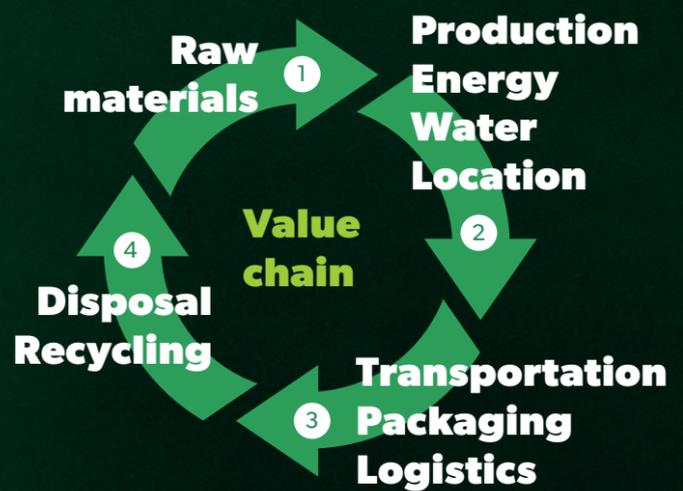
9. Design

- Focus on the key security elements needed for human or machine authentication
- > **Goal: Four times as durable, less material used**

2021

What might the world's most sustainable banknote look like?

We want to know, and so we plan to develop a green concept note by 2021. Watch this space!



**Does
money
need
a new
ethics?**

**How clean
do we want
money to
be?**

**Money
at all
costs?**

**How bio
can a
plastic
banknote
be?**

**Does
money
need to
be certified
organic?**

**What's
the value
of a
damaged
banknote?**

Legal

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**What if no
one has
ever been
paid fairly?**

**Can
a fiver
save the
world?**