PROTECTED

Guardian™ Polymer Banknote Sustainability Report

Sept 2021

V7

CCL Secure

THE POLYMER BANKNOTE PEOPLE

1. Executive Summary

This report aims to establish the facts around the use of polymer banknotes and how Central Banks have lowered their environmental impacts by switching to this new technology. This report uses independent published data commissioned by three central banks (Bank of England, Bank of Canada and Banco de Mexico) to look at the life cycle of banknotes and their impact on Climate Change, Excess Nitrogen, Air Quality, Water Scarcity, Toxicity and Bio Diversity. The overwhelming conclusion is that – with polymer banknotes – there is significantly lower impact across all categories compared to conventional banknotes.

However, CCL Secure is going further. Engaging with our customers and suppliers, we are developing a total circular economy, based on the reuse and recycling of end-of-life banknotes as well as spoiled substrate that naturally occurs during the manufacturing process. We're also working vigorously and proactively to reduce the carbon footprint of our operations.

Looking forward, long life, reusable and recycled polymer banknotes are a better alternative to energy intensive digital payment systems which require massive infrastructure and have a high level of technology redundancy. Polymer banknotes – with their long life reusability and end of life recycling – offer a sustainable circular payment system that is secure, robust, universally available to all, trusted by the public, well-established, and contributes to a government's revenue.

Many charities also rely on cash as their primary source of income to help others in society as do for example, market traders. Both have been heavily impacted by the pandemic in an adverse way with their loss of passing trade or donations and society has suffered as a result. Reducing cash in circulation in favour of digital payments will have a negative effect on the most deprived members of our society.

While some large commercial organisations see potential profits by increasing digital payments and limiting the access to cash, the benefits of cash are still extraordinarily strong.

The modernisation of cash is, however, always necessary and new technologies and security features are constantly being introduced. Governments can benefit from these new technologies by:

1.1 Maintaining access to cash. Although the choice of paying with cash is being limited by some large corporate lobbying and retailer incentives, the need for cash is still strong amongst many sections of the public

1.2 Encouraging their Central Banks to adopt new polymer banknote technologies

1.3 Officering industry incentives to invest in new polymer banknote technology that improves sustainability

1.4 Supporting the recycling of polypropylene products.

The low risk and proven solution of polymer banknotes has led to widespread adoption across an increasing number of countries around the world. Canada, the UK, Australia, New Zealand,

Mauritania, Romania, Vietnam, Costa Rica are among those economies that have adopted polymer for their entire families of banknotes, securing a cleaner, greener and more secure future for their currencies. Around the world, more than 75 billion banknotes that use CCL Secure's world-leading GUARDIAN™ substrate are in circulation.

2. Sustainability of polymer banknotes: Reuse and Recycle

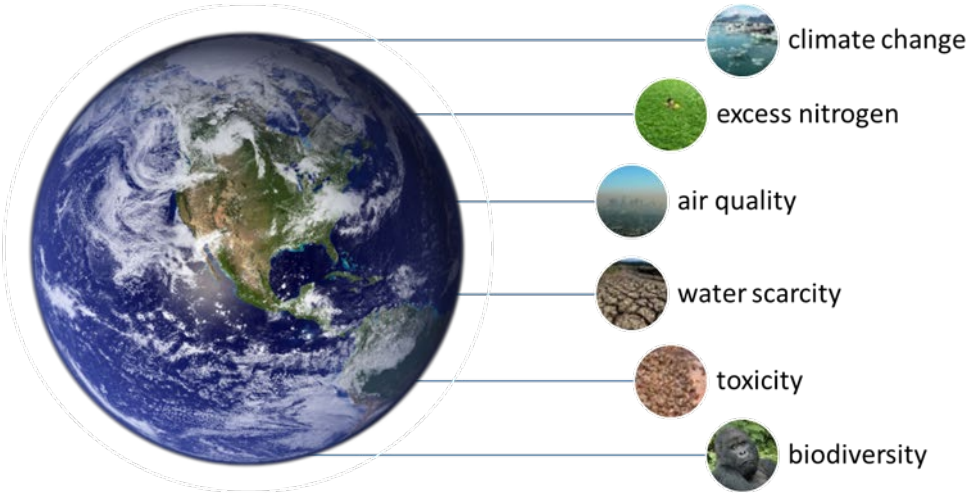
Current estimates indicate that humanity is using the equivalent of 1.7 earths to produce goods and absorb waste according to Global Footprint Network. Basically, that means it takes the earth one year and 8 months to regenerate what humanity uses in a single year. The United Nations has mapped out scenarios and the Global Footprint Network predict that – even on moderate assumptions - we will need the equivalent of two earths to support current population and consumption trends as soon as 2030.

Reuse and recycling has never been more important than at this critical point for our planet.

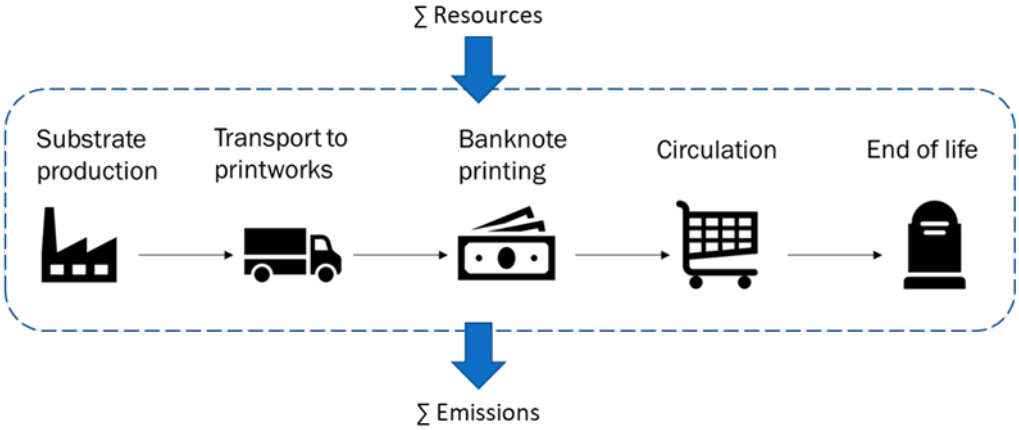
CCL Secure's aim is to offer the greenest, most sustainable and environmentally friendly banknote in the world. By transitioning to polymer banknotes, Central Banks can demonstrate their contribution to a more sustainable banknote and a move towards a circular economy.

Central Banks such as Bank of England, Bank of Canada, and Banco de Mexico have all published the results of their own in-depth studies that compare the environmental impact of paper and polymer banknotes using a number of key measures of sustainability. All the studies show a significantly lower environmental impact for polymer banknotes as they last longer, are reused more, and are widely recycled. These Life Cycle Analysis (LCA) studies are very detailed and provide a rigorous scientific analysis.

There are numerous factors which affect sustainability LCAs are the tools used to measure these. The most commonly known impact is climate change but it is not the only one and you may be aware of the others shown below which all impact on the planet. As the population increases all of these become very significant issues.



As well as the LCAs carried out by the Bank of Canada, Bank of England and Banco de Mexico, other studies have focused on just one type of substrate, including those carried out by the Dutch National Bank and the Swiss National Bank. These Life Cycle Assessment studies are complex but they provide detailed insights into key contributors to different environmental impact measures. Sphera Sustainability Consulting are experts in this field and conducted the analysis for the Bank of England, Bank of Canada and Banco de Mexico.

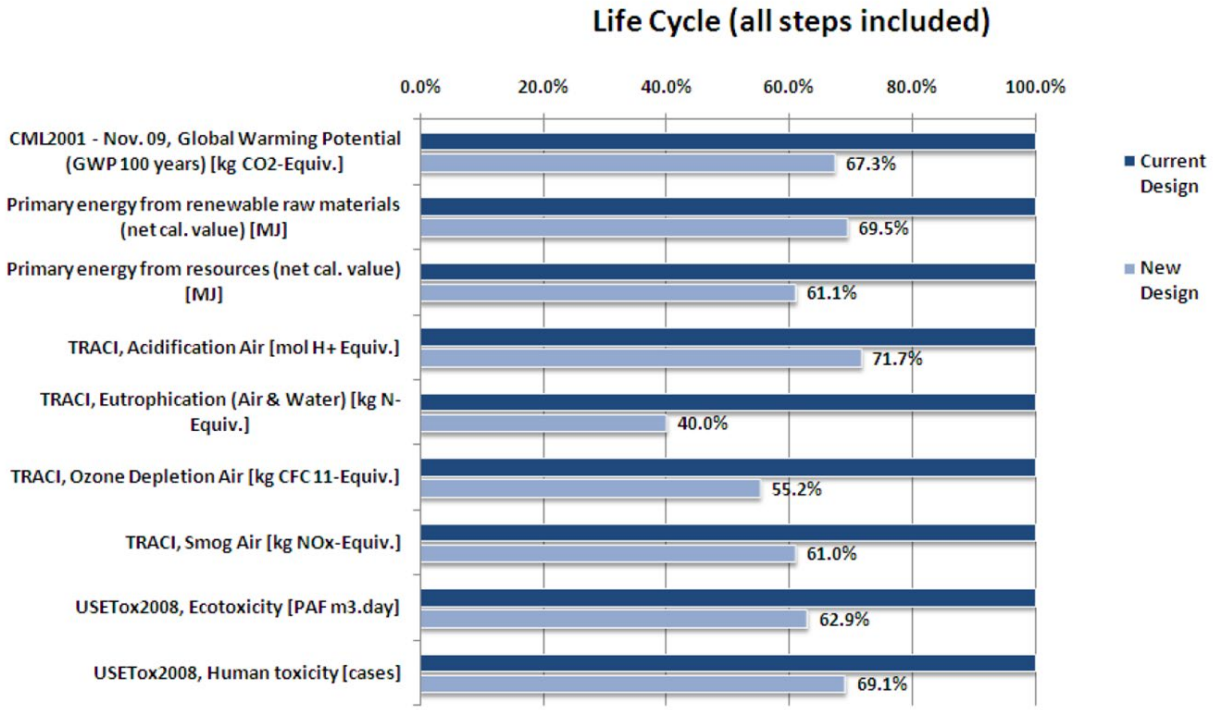


An LCA takes a 'whole life' perspective, considering every step of the process. It works by collecting information on energy and resource inputs, and on emissions to air, water and land, for each step in this life cycle.

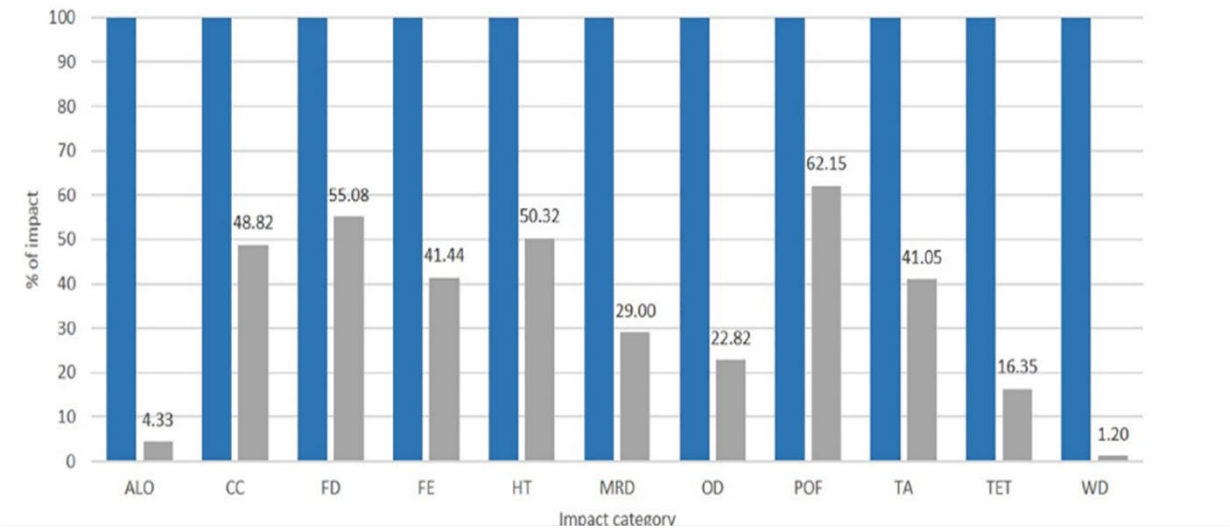
LCAs always report on more than one type of impact, which is what distinguishes them from single-issue indicators such as carbon or water footprints.

The results of the Bank of Canada, Bank of England and Banco de Mexico studies are published on each bank's website. We can see from all three studies that polymer banknotes enjoy a significant advantage over paper banknotes, even long life papers. In Canada there was a 30% to 60% improvement in all categories as shown in the bar chart below. The light blue bar is the polymer series and the dark blue is a paper banknote series. These advantages are well beyond any level of uncertainty, with the light blue measures being consistently less than the dark blue.

Canada: Paper illustrated by dark blue bars and polymer illustrated by light blue bars.



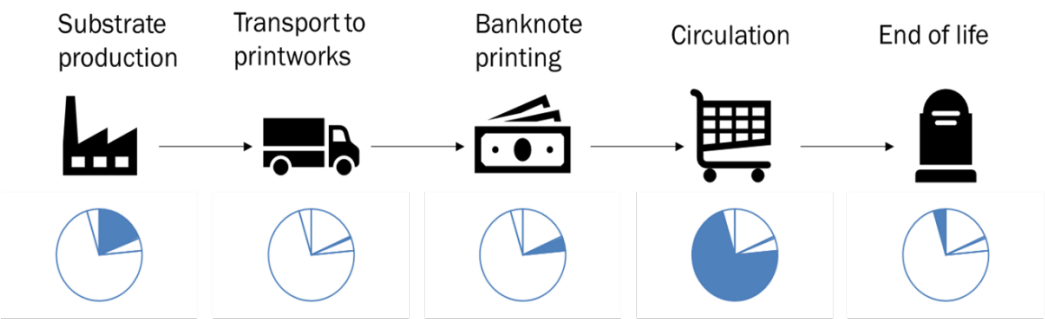
Mexico: Paper illustrated by dark blue bars and polymer illustrated by grey bars.



ALO (agricultural land occupation), CC (climate change), FD (fossil resource depletion), FE (fresh water eutrophication), HT (human toxicity), MRD (mineral resource depletion), OD (ozone depletion), POF (photochemical oxidant formation), TA (terrestrial acidification), TET (terrestrial eco-toxicity), and WD (water depletion). Each figure is normalized to the highest value

In Mexico the differences were even greater in all categories. The climate change is 50% less but water depletion is 99% less. We also see the same positive results for polymer banknote studies in England and Australia.

The reason for these positive, favourable LCA results is due to reuse and note life. In the chart below, we see the impact of each stage of the life cycle in the UK. The blue pie graphs show, that circulation has the biggest impact, accounting for around 70% of the total. This is mainly from transportation of banknotes around the country and distribution to ATMs. With polymer banknotes, we see a minimum 2.5 times fewer banknotes needing to be replaced in circulation. The second biggest impact is substrate production - and we know that many fewer polymer banknotes need to be printed. The study assumed 2.5 times fewer but in reality, it is three to five times. The key message: reuse and then recycle.



Key stages in the banknote life cycle and their contribution to climate change for polymer £5 banknotes

Reuse and recycle is one of the main attractions of polymer banknotes. At each stage of the banknote's life, waste material can be recycled and reused in other products creating a circular economy. A polymer banknote starts its life as a polypropylene pellet and is recycled back to a polypropylene pellet at end of life; ready for making into other useful products.

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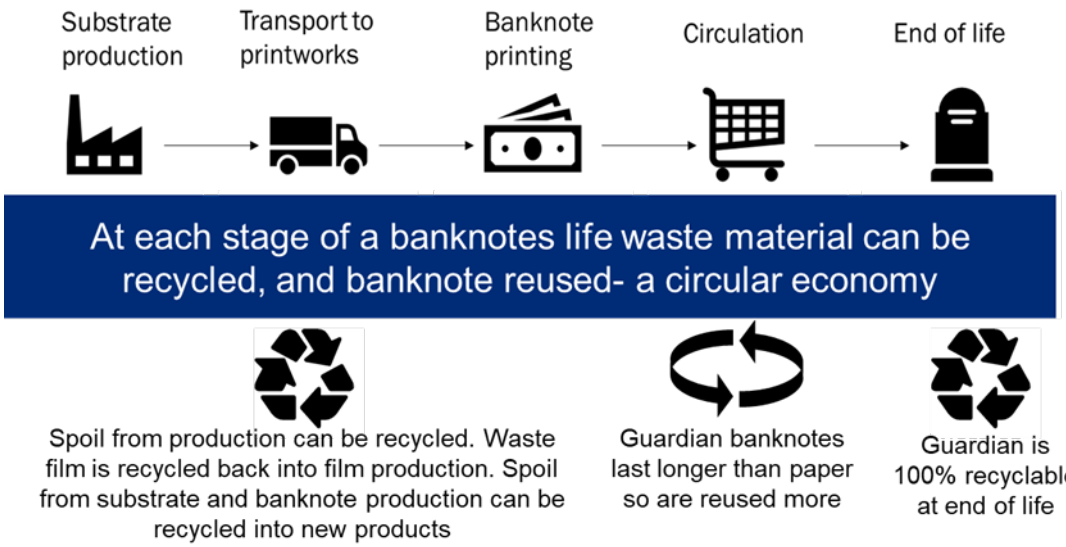


CCL Secure supports and assists customers around the globe to recycle end of life notes, this support includes:

Recycling Support

Standard expert advice and support in recycler contract development

Manage full recycling program including:

- **Identification and testing of at least three recycle operations**
- **Supply of polymer banknote factsheet for recycler**
- **Auditing of recycler and reference customer list**
- **Selection of recycler with multi-national customer list**
- **Contract development and support, for example contract templates for recyclers**
- **Free pick up and transportation of shredded/ granulated polymer banknotes**
- **In-Bank process and control and support for example Central Bank destruction policies and unfit note classification**
- **In-Bank support and guidance for machine modifications (as required)**
- **Annual Recycling Report for a Central Banks Management Team**

With this we can close the loop, so a polymer banknote begins and ends its life as polypropylene pellets, which can then used for long life products such as containers, household goods, or outdoor wood effect products including furniture or decking boards. These uses often do away with the need for cotton or wood products.

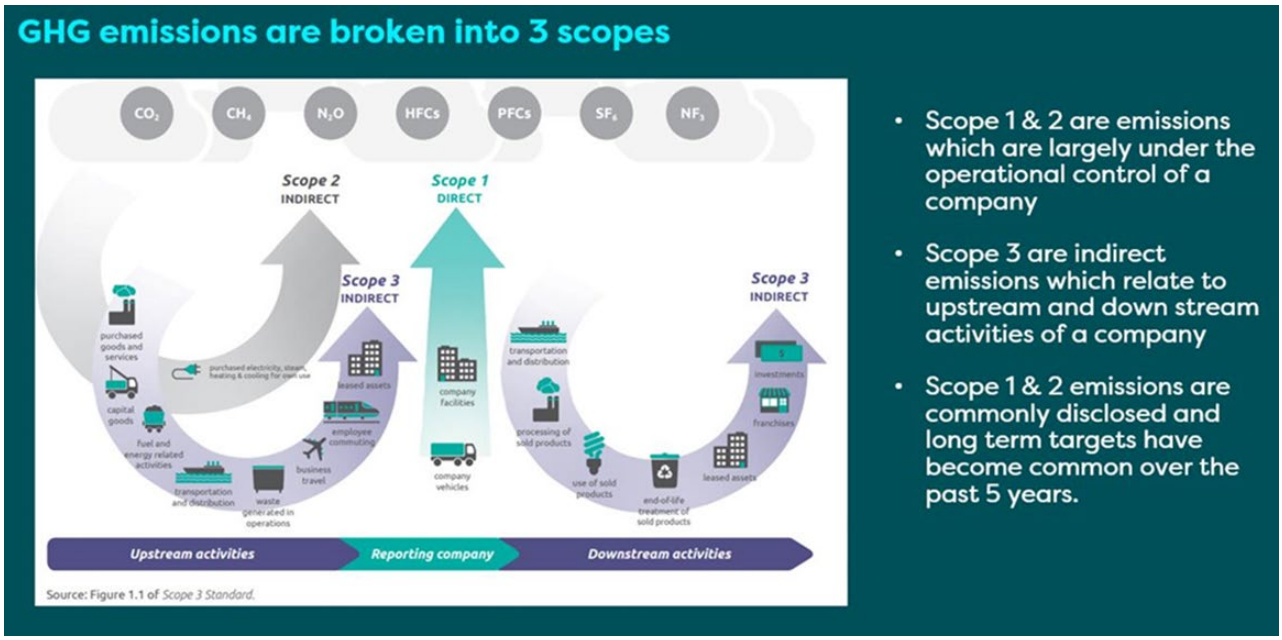
Recycling enhances even further the already significant sustainability advantage of polymer banknotes.

3. How is CCL Secure further progressing sustainability

By looking at the whole cash cycle, CCL Secure can measure its own environmental impact (Substrate Production) and track projects and emissions reduction against the BSI PAS2050 standard, using the IPMVP (International Performance Monitoring & Verification Protocol) method. We focus our efforts on measures, which make a real difference.

Whilst engaging with customers in relation to recycling and providing available recycling options, CCL Secure is also committed to reducing the carbon footprint of substrate production, striving to reduce carbon intensity across all three Greenhouse Gas (GHG) Scopes whilst engaging with customers in the process.

The diagram below illustrates the three GHG emission scopes.



- Scope 1 & 2: Direct and indirect emissions under the control of CCL Secure/
- Scope 3: indirect emissions are upstream and downstream activities of CCL Secure. Upstream activities mainly relate to embodied carbon of our inputs e.g. raw materials and incoming transport. We work closely and regularly with our supply chain to reduce these emissions as much as possible and explore more environmentally friendly solutions to reduce them. Downstream activities for CCL Secure mainly focus on our waste streams. We are currently close to achieving zero waste to landfill status.

- Further downstream emissions sit outside CCL Secure's carbon footprint scope, which is measured on a cradle to gate basis. That doesn't mean we forget about what happens after our product leaves the factory gates. We work closely with our customers providing support every step of the way. We are therefore committed to actively assisting all Central Banks and large volume print works using our Guardian or Spartan products, aiming to recycle 100% of their waste into long-life (multiple use) materials.

in the UK, for instance, since our baseline 2018 year we have:

- Reduced our Carbon Intensity by 20.5%.
- Launched our aim for zero strategy and by the end of 2019 we had reduced it by 9.4% and a further 11.1% at the end of 2020.
- Achieved carbon reduction across all three GHG scopes.
- Achieved all of this without the use of offsets

We made these impressive improvements by:

- **ESOS audit**, 2019, which identified areas for improvement.
- **Efficiency improvements**. Onsite energy consumption reduced from a carbon intensity of 1.46kgCO2e/kg of product to 1.07kgCO2e/kg of product at the end of 2020.
- **Process innovations**. Going beyond efficiency improvements to implement process innovations such as bringing some raw material supply manufactured in house.
- **Scope 3 smart supply chain**. Scope 3 emissions significantly contribute and consequently, step-change interventions to reduce emissions from embodied carbon. Scope 3 emissions reduced from a carbon intensity of 5.78kgCO2e/kg of product in 2018 down to 4.48kgCO2e/kg of product at the end of 2020. This was achieved, working with Verco Global, by a comprehensive materiality assessment. CCL Secure established the embedded carbon of all incoming materials. It assessed the carbon footprint of bought in supplies from raw material to the point where the product entered the site. This data was used to make decisions about sourcing and whether producing those products in-house would be beneficial. For example, with one project, fifteen products are now being manufactured in-house that were previously bought in.

  https://www.vercoglobal.com/clients/ccl-secure/

CCL Secure is targeting carbon neutrality for all its sites by 2030. We are already making strong progress against this goal and have committed that all Bank of England substrate produced in our UK production facility will be carbon neutral by 2022.

CCL Secure is already making real carbon reductions. Some carbon offsetting in accordance with the PAS2060 standard will be required in the short term to reach our carbon neutrality goal. This will be kept as minimal as possible as offsetting is not a long-term strategy.

We've noticed however that we need different approaches in different countries. For example, the makeup of renewables and non-renewables in the national grid impacts carbon usage and offsetting. Supply chains are also different in each country, with variations in the distance of transportation for raw material and finished product.

Other projects currently underway at CCL Secure include:

a. 100% recycling of all polymer waste and aiming to have zero landfill from our sites.

b. 100% reuse of solvents through for example heat recovery or ability to recover solvents to reuse in the production process

c. Alternative ink technologies and redesigning the product to understand relative environmental benefits.

d. Reduced base load energy such as of gas and electricity though efficiency and capital expenditure. This is better insulation, lighting solutions, and automation. For example, gas reduction by 46%% between 2018 to 2021 and electricity reduction by 13% with increasing production output.

e. Reduced base load steam consumption by 36%.

f. Supply chain mostly in-house or local. With three sites in each different region we can optimise our production, so UK buy UK materials or services and supplies Europe. Mexico buys from Mexico and supplies Latin America. And Australia buys Australian and supplies Asia/Pacific. CCL Industries strategy is based on this type of use of local operations. With capital investment of over £40million since 2016 we now have 96% local supply in the UK. In 2020 transport accounted for 2.7% of the site's CO2e/kg, down from 7.9% in 2018 (our base line year). In addition, our sister company Innovia Films - who manufacture the base polymer used in our banknotes – are co-located on two of our three sites reducing the distance travelled to under 300 metres!

g. Spoilage. Having to make a product twice means twice the raw materials and double the energy use. Through capital investment we have seen significant reductions in spoilage, which turn reduces our environmental impact.

4. How can central banks become more sustainable?

Banks such as the Bank of England, the Bank of Canada and many others have converted all of their banknotes to polymer in part to reduce the environmental impact of their banknote issue. They are also working with the industry to look at more efficient cash recycling within retail and commercial banks so that there is less demand for transportation, ATM power consumption, and carbon and non-carbon impact of suppliers. They are also recycling all their shredded polymer banknote waste.

Recycling of shredded polymer waste is an area in which CCL Secure works closely with Central Banks issuing GUARDIAN banknotes. Our aim is for 100% of GUARDIAN waste from print works and Central Banks to be recycled. Currently = just over 90% of end-of-life GUARDIAN notes are recycled, with only a minority of print works and Central Banks not recycling.

5. How Central Banks recycle polymer banknotes

5.1 Note destruction policy.

In developing a Central Bank's recycling programme, the destruction policy will usually need to be adapted. A number of key questions are covered in a checklist that is used by CCL Secure with Central Banks.

Evaluation of Steps for a Central Bank Recycling Process	
Process	**Checklist**
Sorting	▪ Is the fitness sorting process (whether manual or machine) currently set up to process notes of different materials (paper and polymer) together or separately? ▪ Describe the work flow involved in the sorting process, looking for anything that may be impacted by the requirement to keep different materials separate. ▪ If process is set up for mixed processing, what opportunities are there to modify work flow & process to separate materials? ▪ What is the volume of out-sorted unfit notes to be destroyed – on a monthly or annual basis?
Destruction	▪ Is there a destruction process? ▪ Is the destruction process online or offline? (If online, the fitness sorting process cannot process notes of different materials) ▪ What are the reconciliation procedures and any other administrative or regulatory requirements that may be affected by materials separation? ▪ Describe the process flow for destruction, particularly downstream of the granulating step. ▪ Is there a briquetting facility? ▪ How is the waste material collected? (i.e. is it deposited into large bags or other containers) ▪ What is the possibility to use a different type of collection bag? (i.e. is there existing infrastructure in place to hold bag while waste material is collected, etc.)

Disposal	▪ What happens to destroyed waste material before it is disposed of? ▪ Is it stored somewhere and if so, what is the storage capacity? ▪ How frequently does the customer normally arrange for pick-up and disposal of destroyed waste material? ▪ What determines the frequency – is it simply the capacity for storing destroyed waste material? ▪ Describe the process for the pick-up of destroyed waste material ready for disposal. What opportunities are there to change this process? ▪ Describe the existing disposal arrangements (transportation and disposal method). What is the existing cost of disposal? ▪ Describe the layout of the area where granulated waste material is picked up for disposal. What is the possibility of bringing in a 20-ft container to pick up the waste material for shipment? ▪ Are there any local or national regulatory requirements regarding disposal that require conformance? ▪ Is there any regulatory difficulty with the shipment of granulated waste material overseas?

A key requirement for a recycler is, ideally, to have 100% shredded polymer. It is possible to have 95% shredded polymer banknotes and up to 5% contamination of paper, but no more. The image below shows the separation system used for polymer. Instead of bricketing (i.e. compacting the shredded waste into long tubes, the shredded polymer is collected in bags.

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The shredded waste can also be collected in other containers as long as they are clean and dry. As the images from CCL Secure's latest recycling facility in Mexico show, the shredded waste is sucked into a recycling unit, where it is melted. The melted polymer is filtered, gasses extracted and passed through small holes to create long thin "spaghetti" like strands of polypropylene. These are cut up and cooled, crating small pellets.

CCL have their own in house recycling plant

These pellets are then used to create a whole range of new polypropylene products. So, we start with polypropylene pellets and end with propylene pellets, closing the cycle.

Bank of England Recycling

CARBON TRUST STANDARD
REDUCING CO2 YEAR ON YEAR

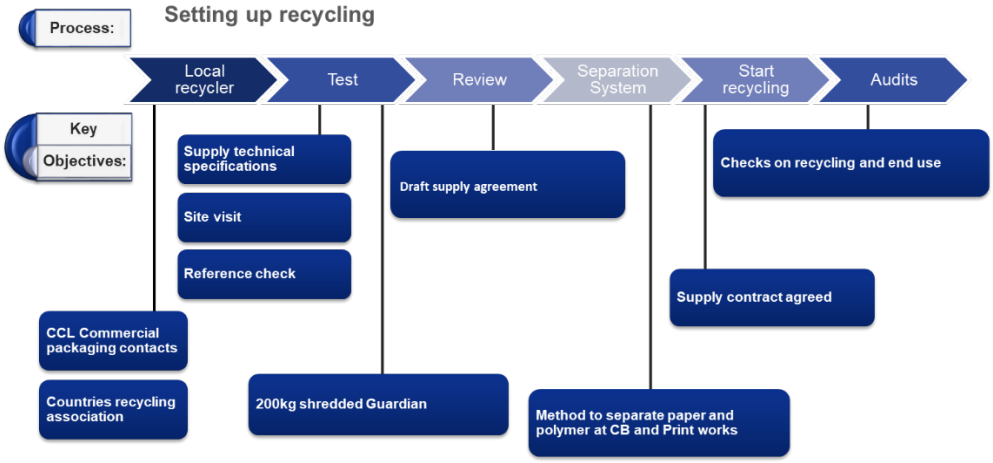
15

Recycled Banknotes






A summary of the recycle process is below:



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Document Control

Version	*Date*	*By*	*Reason/Changes*
V1	14th April 2021	LMcD	New Document
V2	5th Aug 2021	GF/LMcD	Review and update
V3	12th Aug 2021	LMcD	Further review
V4	18th Aug 2021	LMcD	Comments added and sent to JW for comment.
V5	27th Aug 2021	GF	Based on feedback with some more data.
V6	22nd Sept 2021	LMcD	Additional data to support activities
V7	1st Oct 2021	Clarity	Guardian messaging added