

Life cycle assessment of the ninth banknote series 2022

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Under its statutory mandate the Swiss National Bank has the exclusive right to issue Swiss banknotes, and determines their denominations and design. This means that the SNB has an influence on the environmental impact of its banknotes and endeavours to make their life cycle as environmentally compatible as possible.

In 1999, the first comprehensive product life cycle assessment of Swiss banknotes was compiled for the eighth series of banknotes in circulation at the time. After the introduction of the ninth banknote series was complete, in 2021 the SNB commissioned a new product life cycle assessment. The six denominations of the ninth banknote series were put into circulation in stages between 2016 and 2019. Compared with the previous series, the banknotes of the ninth series are more secure and therefore more complex to produce. In particular, they use an innovative Durasafe® substrate, which consists of two layers of cotton paper and a central polymer core. This makes it possible to incorporate new security features, and at the same time increases the mechanical resilience of the banknotes.

This publication describes the procedure for assessing environmental impact and presents the key findings. The entire life cycle of Swiss banknotes, from manufacture and the SNB's logistics to disposal, is taken into consideration. The first chapter looks at the circulation of Swiss banknotes. The second chapter describes the aim and methodology of the life cycle assessment, as well as presenting the processes examined and the most important findings. The third chapter contains conclusions and an outlook.

1

Banknotes in circulation

Pursuant to art. 7 of the Federal Act on Currency and Payment Instruments (CPIA), the SNB issues banknotes commensurate with demand for payment purposes and, in return for payment of their nominal value, redeems any banknotes which are worn, damaged or surplus to requirements.

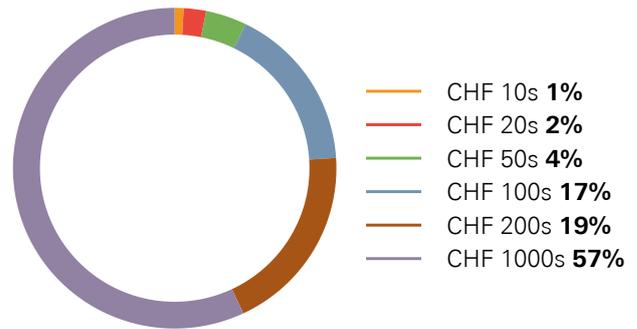
In 2021, banknotes in circulation averaged CHF 88.3 billion, 4.5% more than in the previous year. The total quantity of notes in circulation averaged 532.0 million, 3.6% higher than in 2020.

In terms of value, the large denominations made up the largest proportions (cf. chart 1). The high proportion of large denominations indicates that banknotes are not just used as a means of payment, but also as a store of value. In contrast, the distribution by quantity of notes is much more balanced (cf. chart 2).

Chart 1

BANKNOTE CIRCULATION BY VALUE

Average proportion of each denomination in 2021

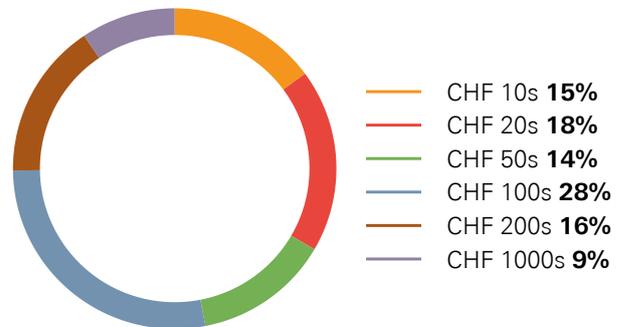


Source(s): SNB

Chart 2

BANKNOTE CIRCULATION BY QUANTITY

Average proportion of each denomination in 2021



Source(s): SNB

2

Life cycle assessment of Swiss banknotes

2.1 AIM AND METHODOLOGY

Under art. 4 of the National Bank Act, the SNB has the exclusive right to issue Swiss banknotes. Under art. 7 of the CPIA, it also determines the denominations and design of the notes. This means that the SNB has a considerable influence on the environmental consequences of the manufacture and use of banknotes. The SNB has set itself the aim of making the entire life cycle of Swiss banknotes as environmentally compatible as possible while complying with the stringent security requirements that are naturally given particular importance.

The SNB has employed life cycle assessment methodology to capture and evaluate the environmental impact it can influence across all steps of the process. This involved examining the effects on the environment of supplying the market with the ninth banknote series. The analysis covers the manufacturing process and SNB logistics as well as disposal of the banknotes. The assessment did not take account of the local distribution and use of the banknotes in circulation. The raw materials used and emissions to air, water and land were analysed and evaluated for all the processes assessed.

The life cycle assessment was compiled in line with ISO standard 14040. The study was based on the average quantity of Swiss banknotes produced annually. For the ninth series this is around 80 million banknotes. The average quantity of notes produced annually for the eighth series was around 115 million.¹ This reduction of some 30% is due on the one hand to the fact that ninth-series banknotes are more mechanically robust, and on the other to a decline in the use of notes as a means of payment. Both these factors have contributed to an increase in the average lifespan of banknotes.

2.2 THE BANKNOTE LIFE CYCLE

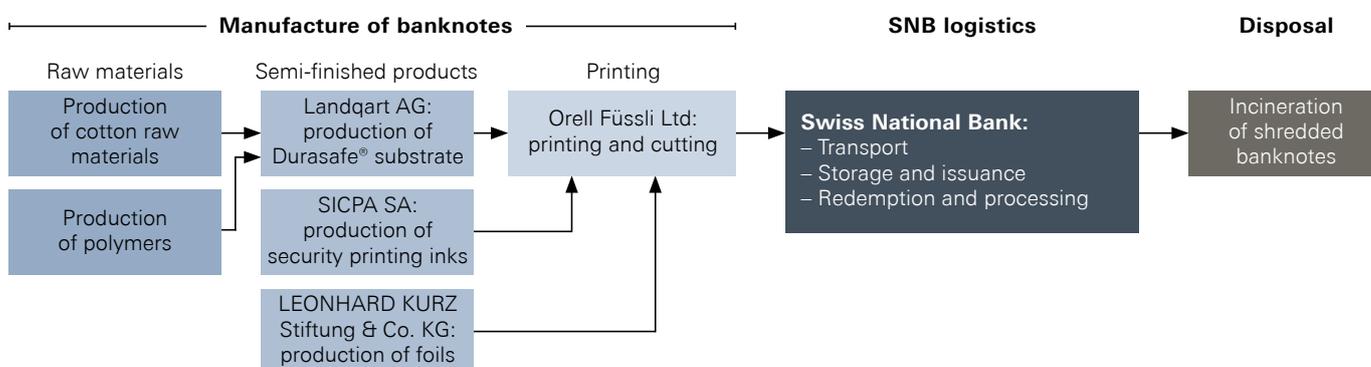
2.2.1 PROCESSES IN THE BANKNOTE LIFE CYCLE

A banknote goes through various phases in the course of its life cycle. The analysis for the life cycle assessment covered the manufacture of the banknotes, SNB logistics and the disposal process. The manufacture of banknotes was in turn broken down into the provision of raw materials, the manufacture of the requisite semi-finished products, and the printing of notes (cf. chart 3).

¹ The life cycle assessment of the eighth banknote series compiled in 2000 assumed average annual production of 100 million notes.

Chart 3

PROCESSES IN THE LIFE CYCLE OF NINTH-SERIES BANKNOTES



2.2.2 MANUFACTURE OF BANKNOTES

The ninth-series banknotes are printed on Durasafe[®], an innovative substrate produced by Landqart AG. The central core of the banknotes is made of a polymer, while the two cotton-based outer layers are made of by-products from the production of cotton. In addition to the Durasafe[®] substrate, the production of banknotes also requires specially coated foils with kinetic image structures manufactured by LEONHARD KURZ Stiftung & Co. KG, as well as security printing inks supplied by SICPA SA.

Swiss banknotes are printed by Orell Füssli Ltd. They are manufactured in a process comprising a total of seven different printing procedures, one application procedure and one perforation procedure. The printing process begins with offset printing, followed by screen printing, an application procedure, copperplate printing, a perforation procedure, letterpress and varnishing. The process concludes with cutting the sheets into single notes and an automated check of the printing quality of each individual banknote. Defect-free banknotes are packaged and delivered to the SNB, while defective ones are sent for automatic destruction. Quality control is carried out at the SNB by means of spot checks. If the notes successfully pass quality control, they are stored at the SNB and later put into circulation.

2.2.3 SNB LOGISTICS

Issuance and redemption of banknotes is carried out via the SNB's network of cash distribution services. This network comprises the two bank offices at the SNB's head offices in Berne and Zurich plus 13 agencies run by the cantonal banks. In 2021, 279.0 million notes were issued and 268.7 million were redeemed.

Banknotes that find their way back to the SNB from circulation undergo a quality and authenticity check by machine (cf. fig. 1). Notes that have been checked and that are still in good condition are put back into circulation.

2.2.4 DISPOSAL

The sorting machines used to process the notes have an integrated shredder that destroys – in one and the same process – banknotes identified as genuine but no longer fit for circulation. The banknote scraps that are produced in the shredding process are pressed and subsequently brought to public waste incineration plants (cf. fig. 2). At the waste incineration plants both thermal and electrical energy are recovered, thus contributing to Switzerland's energy supply.

Fig. 1



SNB sorting machine

Fig. 2



Shredded banknotes compressed for transport to incineration

2.3 RESULTS OF THE LIFE CYCLE ASSESSMENT OF THE NINTH BANKNOTE SERIES

2.3.1 OVERALL ENVIRONMENTAL IMPACT

The present life cycle assessment evaluates the environmental impact of the average quantity of banknotes produced annually using the ecological scarcity weighting method published in 2013 by the Federal Office for the Environment (FOEN).² This method weights a large number of environmental factors (for example impact on the climate, environmental acidification and use of resources) in line with Switzerland's regulatory requirements and policy objectives. The ecological effects of all the environmental factors assessed are aggregated and reported as environmental impact points (EIP).

Chart 4 shows the environmental impact points for the individual life cycle phases. The manufacture of banknotes accounts for 82% of the total environmental impact, with 50% arising from the provision of raw materials. SNB logistics (16%) is of minor importance in terms of overall environmental impact, and disposal (2%) is virtually negligible.

² Frischknecht and Büsler (2013): R. Frischknecht and S. Büsler Knöpfel, Swiss Eco-Factors 2013 according to the Ecological Scarcity Method, Federal Office for the Environment FOEN, Environmental studies series no. 1330, Berne, Dec. 2013

The most important factors in the overall environmental impact of banknotes are:

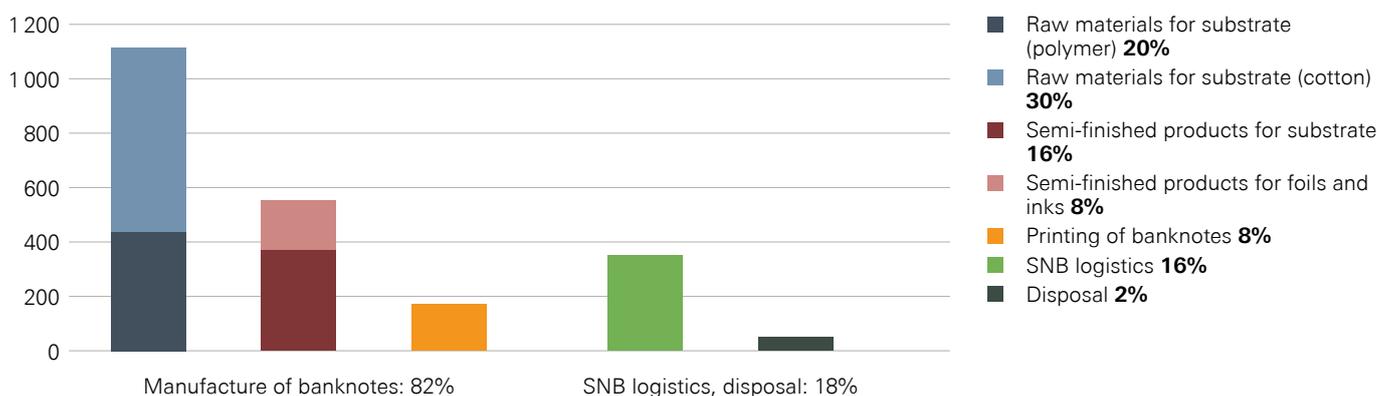
- **Quantity of materials:** The production of the substrate is a significant process step in terms of overall environmental impact. The quantity of materials used depends on the weight of the banknote and the amount of scraps generated in all the steps of the banknote production process.
- **Materials:** The environmental footprints of materials differ. Cotton raw materials, for example, have a lower environmental impact per quantity used than polymers.
- **Power mix:** The type of electricity generation has a significant impact on the environmental footprint. Electricity generated from renewable resources has a significantly lower environmental impact than electricity generated by conventional means. This means that the power mix used in the various steps of the process influences the overall environmental impact.
- **Lifespan:** The lifespan of banknotes in use and the user behaviour of members of the public directly determine the number of banknotes required, and thus influence the environmental impact.

Chart 4

OVERALL ENVIRONMENTAL IMPACT OF ANNUAL BANKNOTE PRODUCTION

Total 2.2 billion environmental impact points (EIP)

In millions of EIP



Source(s): SNB

2.3.2 EFFECT ON THE CLIMATE

One component of overall environmental impact is the effect on the climate. Given the great relevance of climate change in society, the greenhouse gas emissions of the individual steps in the process are reported separately in the life cycle phases under consideration (cf. chart 5).

The distribution of greenhouse gas emissions for the individual steps in the process is comparable with the overall environmental impact. The manufacture of the notes accounts for 82% of total greenhouse gas emissions, SNB logistics 13%, and disposal of the banknotes 5%. The total annual climate emissions are around 1,900 tonnes of CO₂ equivalents, which corresponds to 0.003% of Switzerland's total emissions, or the annual emissions of a Swiss village of 300 people.

2.3.3 CLIMATE OFFSETS

The SNB's climate strategy consists in reducing operational greenhouse gas emissions and offsetting unavoidable emissions with high-quality climate certificates. In this way, the SNB's operational processes – including the logistics processes covered in the present study – have been carbon neutral since 2011.

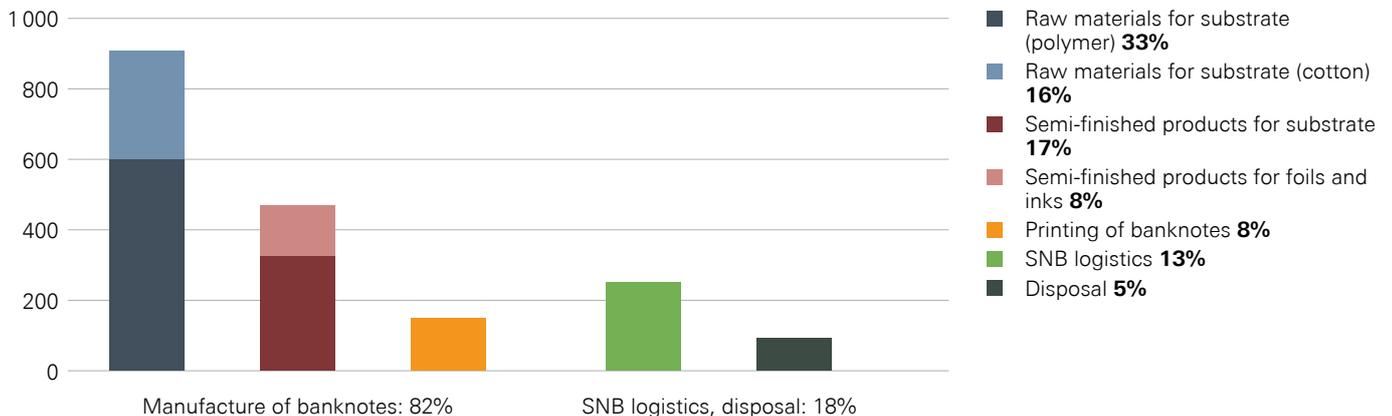
Furthermore, the SNB undertakes to make the design and manufacture of banknotes, its logistics and the disposal of banknotes as environmentally compatible as possible. On the basis of the present life cycle assessment of the ninth banknote series, the SNB is retrospectively extending its climate offsets, with the result that the issuance of the ninth banknote series has had a neutral carbon footprint throughout the life cycle phases under review.

Chart 5

GREENHOUSE GAS EMISSIONS OF ANNUAL BANKNOTE PRODUCTION

Total: 1,900 tonnes of CO₂ equivalents

CO₂ equivalents, tonnes



Source(s): SNB

2.4 LIFE CYCLE ASSESSMENTS OF THE EIGHTH AND NINTH BANKNOTE SERIES COMPARED

A comparison of the two banknote series reveals that the overall environmental impact of the ninth banknote series is just under 20% lower than that of the eighth (cf. chart 6).

The banknotes of the ninth series are significantly more secure and resistant to wear and tear than those of the eighth series. The main reason for this is the use of Durasafe[®], a substrate consisting of both higher-quality cotton raw materials and polymer. The substrate used for the eighth banknote series, by contrast, was made without polymer.

Given the different manufacturing technologies and product characteristics, there are significant differences in the environmental impact of the various life cycle phases of the eighth and ninth banknote series. The most important reasons for these differences are as follows:

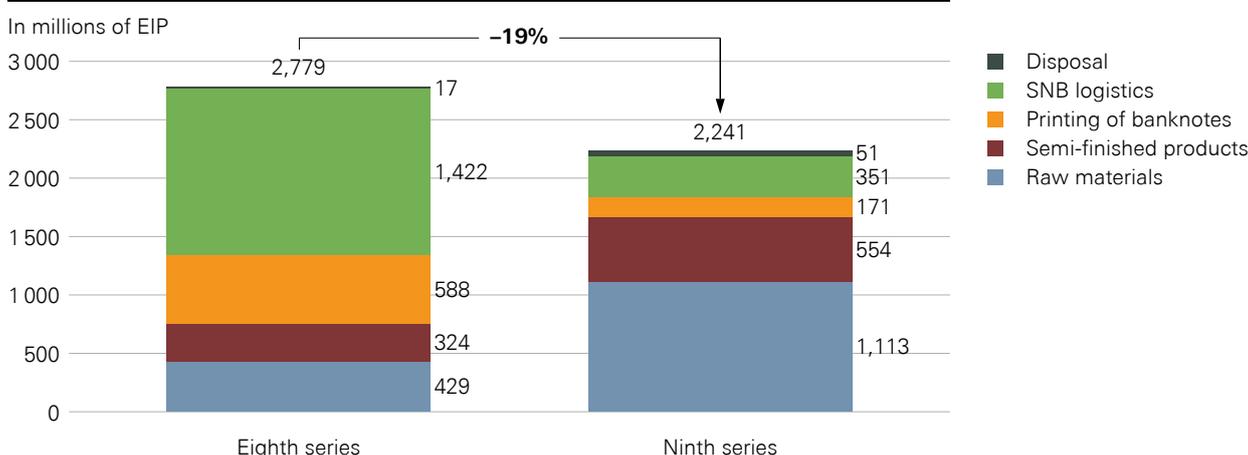
- **Raw materials:** Because of the use of polymers and higher-quality cotton raw materials, the ninth banknote series has a significantly larger environmental footprint than the eighth.
- **Semi-finished products:** The Durasafe[®] substrate used for the ninth banknote series is more complex to produce than the pure cotton substrate used for the eighth series. The greater environmental impact of this is partially offset by the fact that the companies involved in the manufacture of the semi-finished products have switched to renewable resources to cover their entire electricity requirements.

- **Printing of banknotes:** The environmental impact of the process used to print the ninth banknote series is considerably lower than for the eighth series. A key reason for this is likewise a switch to electricity from renewable resources.
- **SNB logistics:** The SNB's processes also had a significantly lower environmental impact for the ninth banknote series because of improved processes and resources and the switch to green power products.
- **Disposal:** The environmental impact of disposal is comparatively small for both banknote series.

While the use of polymer is detrimental to the overall environmental impact of the raw materials used, the lifespan of ninth-series banknotes is longer because of their improved mechanical resilience. Together with the declining use of banknotes as a means of payment, the result of this is that the SNB replaces fewer worn or damaged banknotes overall, which has led to a reduction of around 30% in the average quantity of banknotes produced annually.

Chart 6

OVERALL ENVIRONMENTAL IMPACT OF EIGHTH AND NINTH-SERIES BANKNOTES PRODUCED ANNUALLY



Source(s): SNB

The environmental footprint of the manufacture and disposal of the ninth banknote series, and SNB logistics, is smaller than that of the eighth series. All in all, the issuance of Swiss banknotes has a low environmental and climate impact.

The life cycle assessment has enabled the annual climate emissions resulting from the manufacture and disposal of banknotes, and SNB logistics, to be quantified. The insights allow the SNB to put into practice its aspiration to supply banknotes on an environmentally-compatible basis, as well as to fully offset unavoidable climate emissions. The climate emissions originating from SNB logistics are part of the SNB's operational processes and have been offset with high-quality certificates from climate protection projects since as early as 2011. Since the SNB retrospectively offsets climate emissions resulting from the manufacture and disposal of banknotes to the introduction of the ninth banknote series, its issuance has had a neutral carbon footprint since it was first launched.

However, climate offsetting is only designed to neutralise unavoidable emissions. In addition, recent years have seen many improvements made to significantly reduce the environmental impact in many phases of the banknote life cycle. In future, the SNB intends to continue down this path with its partners. This applies both to the production of the ninth banknote series and to the further development of Swiss banknotes. The findings of the life cycle assessments of the eighth and ninth banknote series will flow into this, and environmental compatibility will continue to be an important criterion alongside stringent anti-counterfeiting and product quality requirements.

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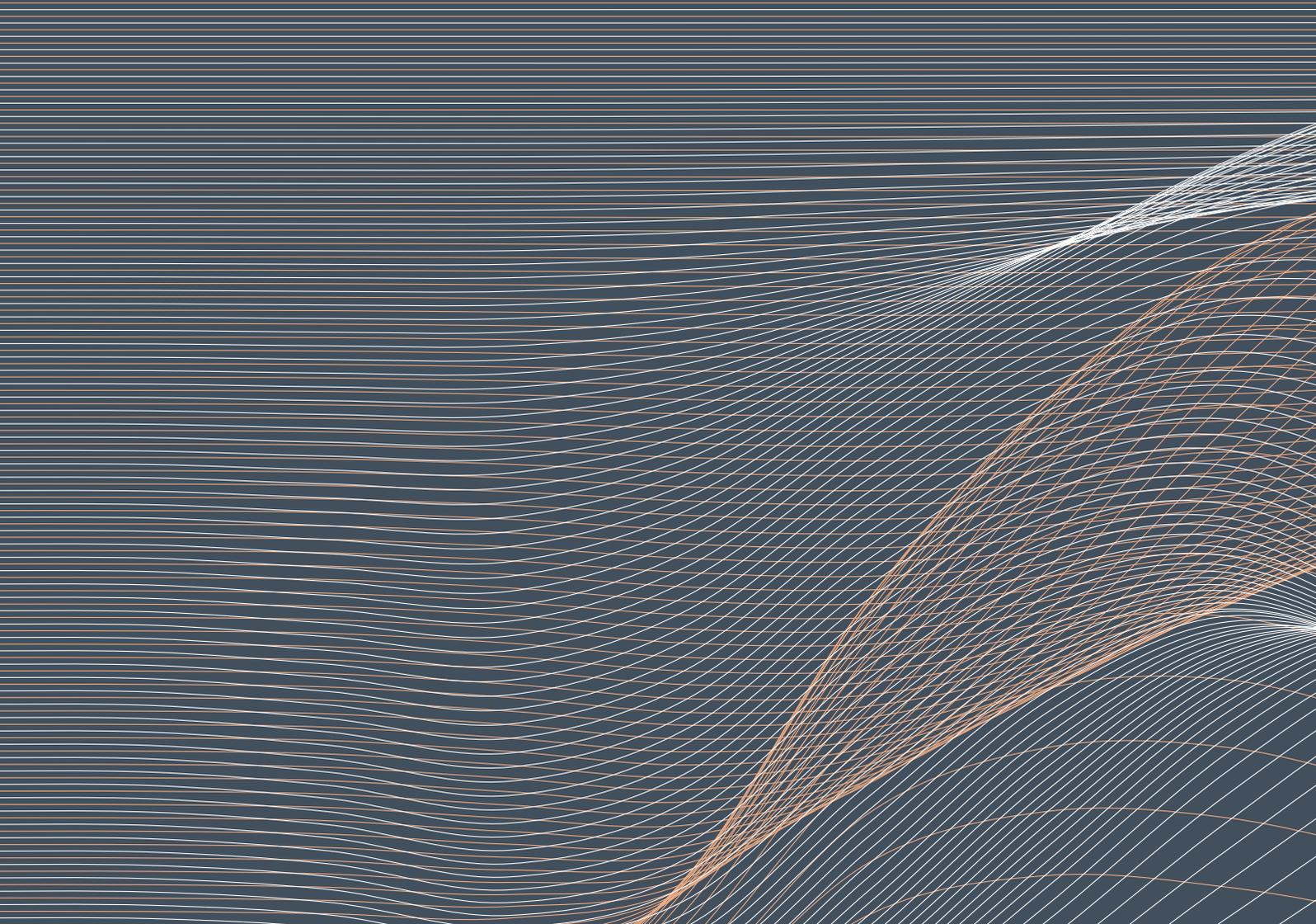
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