



Carbon management for climate protection

The Carbon Management Strategy of North Rhine-Westphalia

Executive Summary





In order to achieve the goal of net greenhouse gas neutrality in North Rhine-Westphalia and Germany by 2045, a fundamental transformation of industry is necessary – from a production and economic system that is currently still shaped by fossil fuels into a climate-neutral one.

This transformation will not be possible with renewable energies and climate-neutral hydrogen alone. Of course, renewable energies are a basic requirement for industrial change and hydrogen is a key element for achieving climate neutrality. However, the sustainable use of carbon is at least as important – especially in industry.

However, carbon has something of a bad reputation when it comes to climate protection. That's because carbon dioxide, which is harmful to the climate, is produced when fossil fuels such as crude oil, natural gas, coal and limestone are used. That's why doing away with carbon – without any exceptions – is called for occasionally.

Total industrial decarbonisation is not the solution

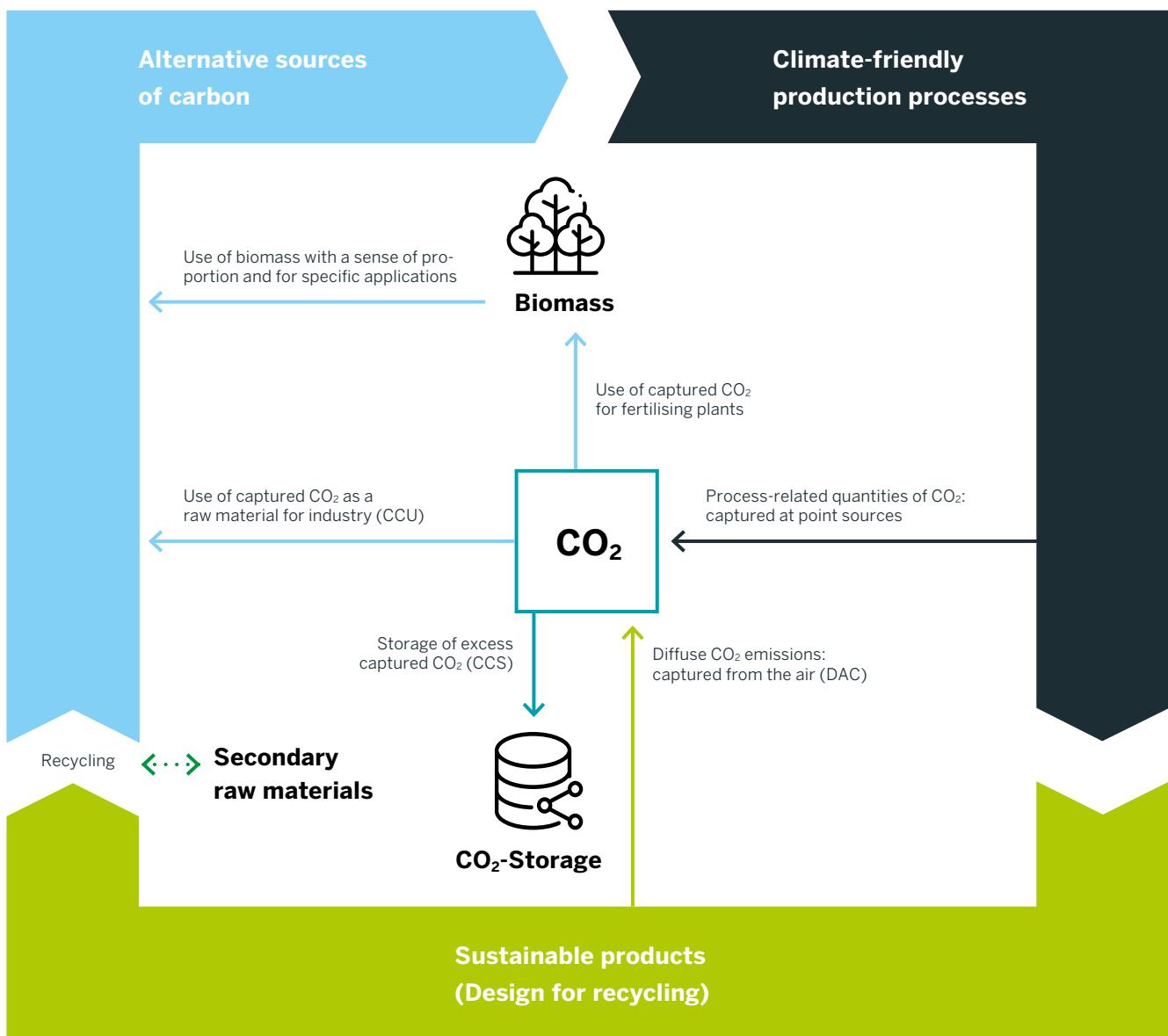
However, total “decarbonisation” is neither viable nor desirable. Primary products essential to a modern industrial society – such as steel, aluminium, cement and plastic – are either made from carbon or need it in order to be manufactured. Without carbon, industry is just as impossible as the production of cars from steel, bridges from concrete and a wide range of products from plastic. That means that industry in North Rhine-Westphalia cannot do away with carbon entirely in the future – but it can rethink how it uses carbon and use it differently to protect the climate as much as possible.

Make the use of carbon climate-friendly

North Rhine-Westphalia intends to become the most modern and climate-friendly industrial location in Europe. As a pioneer in climate-neutral transformation, North Rhine-Westphalia should also represent secure jobs and value creation in industry in the future. Avoiding carbon leakage, i.e. the exodus of companies into regions with less ambitious climate goals, is essential – for the good of the climate and for NRW as a strong location. However, the transformation of industry is much more than the electrification of processes or the use of hydrogen

instead of coal. It is only through the additional development of a “carbon management” strategy that change in industry can succeed. The aim is to cycle the carbon already present in the economic system in order to avoid the addition of more fossil fuels and the generation of CO₂. To this end, the use of fossil fuels must be reduced as much as possible in the future, and replaced with sustainable alternatives, such as secondary raw materials, biomass or CO₂ obtained through recycling.

Figure 1: Targeted carbon cycle



Material flows need to be reorganised

Industry in North Rhine-Westphalia is interconnected extremely tightly across the different sectors. What is a by-product or waste product in one sector is used as a valuable raw material in another. These connections are crucial for profitability and competitiveness. A change to the primary carbon base, material flows and production processes means that the by-products used in a variety of ways today will change or disappear.

That means, for example, if a climate-friendly direct reduction is implemented with hydrogen in steel production, it will change the steel slag produced. However, this slag is used as an important aggregate in cement production. Other by-products such as coal flue ash from power plants that is also used in cement production will disappear completely in the future. Other sectors are showing corresponding changes in networking. It is important to develop new synergy potentials based on sustainable material flows in order to be able to use the opportunities that lie in the changing value-creation pathways. The puzzle of value creation in North Rhine-Westphalia must be put together again.

Use CO₂ as a source of carbon and store it

CO₂ represents a highly promising alternative source of carbon, especially in the chemicals industry. Nevertheless, even if all efficiency, innovation and CO₂ usage potentials (CCU) are exploited, investments are brought forward and all the players cooperate, there will still be irreducible amounts of CO₂ that stand in the way of climate neutrality. According to the study "Climate Neutral Germany 2045", this amounts to approx. 80 million tonnes per year for the whole of Germany in 2045, of which 31 million tonnes per year come from the industrial sector. This means that without the use of Carbon Capture and Storage (CCS), it will not be possible to achieve climate neutrality in industry, in North Rhine-Westphalia or Germany. Nevertheless, the capture and storage of CO₂ should be the last resort if all other options have been exhausted.

The remaining CO₂ quantities of 31 million tonnes per year in industry – measured against today's emissions – would correspond to a drastic reduction of 83% in just under 25 years. By way of comparison: in the last 30 years, German industry has been able to reduce its emissions by around 37%. Industry would have to more than double its future rate of CO₂ reduction by 2045 in order to reach this level of remaining CO₂ emissions.

With the Carbon Management Strategy NRW, we are presenting guidelines for the sustainable use of carbon in industry for the first time and showing the way to a climate-neutral carbon economy:

① **1. Decarbonisation first – but appropriate.**

The carbon intensity in our industry must be reduced. In specific subsections of industry, doing away with carbon is possible and effective. We want to unlock this potential: applications that can be decarbonised in a sustainable – i.e. economical, ecological and socially acceptable – way must be decarbonised. The industry must develop carbon-free processes and technologies. In particular, the required process energy should be as free from carbon as possible; that means it should be sourced from wind and solar energy or climate-neutral hydrogen.

② **2. Alternatives instead of fossil fuels.**

Primarily secondary raw materials.

If it is not possible or expedient to decarbonise an application, there should be a shift in the raw material base to alternative carbon sources where possible. Secondary raw materials should generally take priority over biomass and CO₂. Recycling management is the key for transformation and for the competitive restructuring of the value chains. Recycling must become “the” central material flow for industry in North Rhine-Westphalia.

③ **3. Regardless of whether carbon is done away with or if alternative sources are found, the balance must be right.**

The energy and carbon footprint of the value creation pathway is the main indicator for the effectiveness of decarbonisation and / or the changeover to an alternative source of carbon. In principle, when choosing the value-creation pathway, it is important to bear in mind that the carbon footprint must be at least as good as that of the best conventional pathway. The quantities produced while the product is used are to be assessed as significantly less beneficial than those produced during production as it is possible to capture CO₂ relatively efficiently at point sources. Alternative process routes must be considered in an open-minded and holistic way and weighed up in terms of their suitability.

④ **4. CCU is not automatically climate-neutral. The origin and destination of the CO₂ are significant.**

The capture and usage of CO₂ (CCU) is not automatically climate-neutral or sustainable. The main question here is of its origin and destination during and after use. If the CO₂ used is released again in the short term, as is the case with synthetic fuels, the net CO₂ reduction is significantly diminished if grey CO₂ – which is produced when fossil carbon is recycled – is used. If, on the other hand, green CO₂ – i.e. CO₂ produced when recycling biomasses – is used in products that permanently chemically bind it, a (temporary) positive effect on the climate (“negative emissions”) is on the cards. Companies are encouraged to take the entire carbon life cycle and energy efficiency into consideration when implementing projects and selecting technologies.

⑤ **5. No CCS without CO₂ infrastructure.**

No climate-neutral industry without CCS.

Without proactive and transparent CO₂ management that also includes the use of CO₂ and the storage of unavoidable excess quantities of CO₂, we will not be able to establish climate neutrality in industry. As a result, we need CO₂ infrastructure in North Rhine-Westphalia and beyond that makes it possible to capture CO₂, and to transport it for the purposes of using it and storing it (CCS). We will press ahead with the planning and development of this infrastructure at full speed. We also urge the Federal Government to create the necessary legal conditions.

⑥ **6. CCS is the final building block for climate neutrality. There must be no lock-in effects.**

The capture of CO₂ at a point source and the subsequent possibility of storing it must not be allowed to slow down the reduction of the quantities of CO₂ produced in the process (lock-in effects). In addition, a pipeline infrastructure must not remain as an unused investment (stranded assets) after converting to completely CO₂-free processes is complete. Public utilities power plants, in particular, should neither install any carbon capture equipment nor connect any CO₂ pipeline network; rather, CO₂ in the energy sector must be reduced through the implementation of renewable energies, which are significantly more economical here

North Rhine-Westphalia will take up activities in the following four fields in order to continue accelerating the transformation into a climate-neutral and competitive Low Carbon Industry based on the guidelines above.

FIELD I:

- Reduction of carbon intensity in industry in North Rhine-Westphalia

We want to facilitate the reduction of carbon intensity and accelerate the transformation from a High Carbon Industry into a Low Carbon Industry. In the long term, completely doing away with carbon is necessary in those sectors that are amenable to decarbonisation. Developments supported by the state government – such as the boosting of the hydrogen economy, the expansion of wind and solar energy, the expansion of energy infrastructures such as grids and storage facilities and the promotion of carbon-free processes and technologies – accompany efforts to decarbonise industry.



M1 Targeted development of carbon-free technologies and processes in North Rhine-Westphalia



M2 Accelerated boost of the hydrogen economy in North Rhine-Westphalia



M3 Expanding the supply of renewable energies in North Rhine-Westphalia



M1 Sustainable use of biological resources in North Rhine-Westphalia



M2 Carbon monitoring in North Rhine-Westphalia



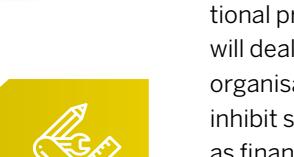
M3 Benchmark of sustainable value-creation pathways with a focus on North Rhine-Westphalia



F1 Level Playing Field and Carbon Leakage protection: achieve consensus on CCU in the EU ETS, CCfD on a European level, CBAM



F2 Adequate funding landscape for a Low Carbon Industry: adjustment of Federal Funding Guidelines, increase and expansion of the CCfD pilot programme on a federal level, federal funds and co-financing for an IPCEI LCI



F3 Expansion of the secondary raw material basis: standards, limits and test specifications on a European level, attribution of chemical recycling, optimised secondary raw material management

FIELD II:

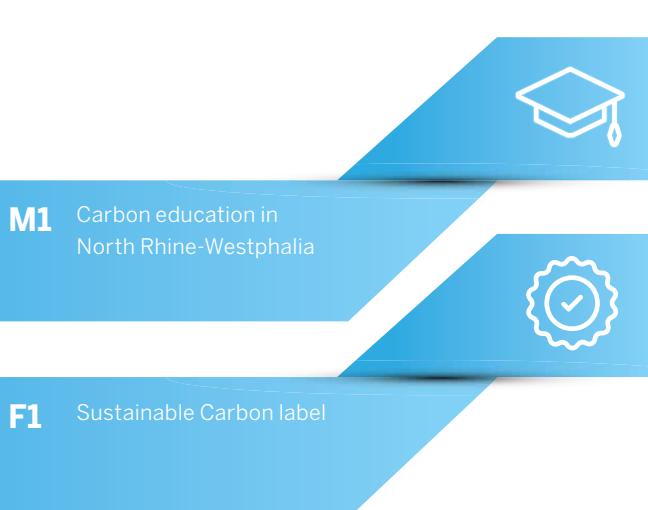
- Sustainable carbon usage in North Rhine-Westphalia

We want to establish the sustainable use of carbon in North Rhine-Westphalia. This includes the adequate use of biomass and the targeted expansion of the secondary raw material base and the (further) development of carbon capture and usage applications. The pre-requisite for a sustainable economy with carbon is the open-minded consideration of various alternative value-chain pathways – both in comparison with the respective conventional process and with each other. We will deal with economic, regulatory and organisational conditions that currently inhibit sustainable carbon usage as much as financial ones in the short term to facilitate the rapid transformation into a sustainable, circular economy in North Rhine-Westphalia.

FIELD III:

→ CO₂ management

We will work to ensure that suitable options for the capture, transportation, usage and storage of carbon dioxide become viable. They must be examined speedily and in an open-ended manner in order to facilitate their immediate and long-term contributions to emission reductions, without which our climate protection goals cannot be achieved. We will campaign at a federal level to ensure that the legal conditions are achieved. We will advance the CO₂ infrastructure planning in North Rhine-Westphalia at the same time.



FIELD IV:

→ Social discourse

We want to take social involvement to a new level in North Rhine-Westphalia through early integration, transport information and comprehensible, mutually designed processes. The outlined transformation of industry will certainly involve comprehensive changes which will also require acceptance in society. This is precisely why we want to design the future of our State together with, and on an equal footing with, its citizens.

Figure 2: Carbon Management Plan NRW

Carbon Management Strategy NRW

The Netherlands

FIELD I

→ Reduction of carbon intensity

FIELD II

→ Sustainable carbon usage

FIELD III

→ CO₂ management

FIELD IV

→ Social discourse

2021 2022 2023

M1

Targeted development of carbon-free technologies and processes in NRW

M2

Accelerated boost of the hydrogen economy in NRW

M3

Expanding the supply of renewable energies in NRW

M1

Sustainable use of biological resources in NRW

F1

More ambitious adaptation of the legal framework for the handling of CO₂ in Germany

M1

CO₂ transportation infrastructure for NRW

M2

National and international CCX cooperation with NRW

F2

Adequate funding landscape for a Low Carbon Industry

F1

Level Playing Field und Carbon Leakage protection

M3

"CCU model regions in NRW" funding competition

M2

Carbon Monitoring in NRW

M3

Benchmark of sustainable value-creation pathways with a focus on NRW

M Measure

F Requirement



Lower Saxony

2024

2025

2026

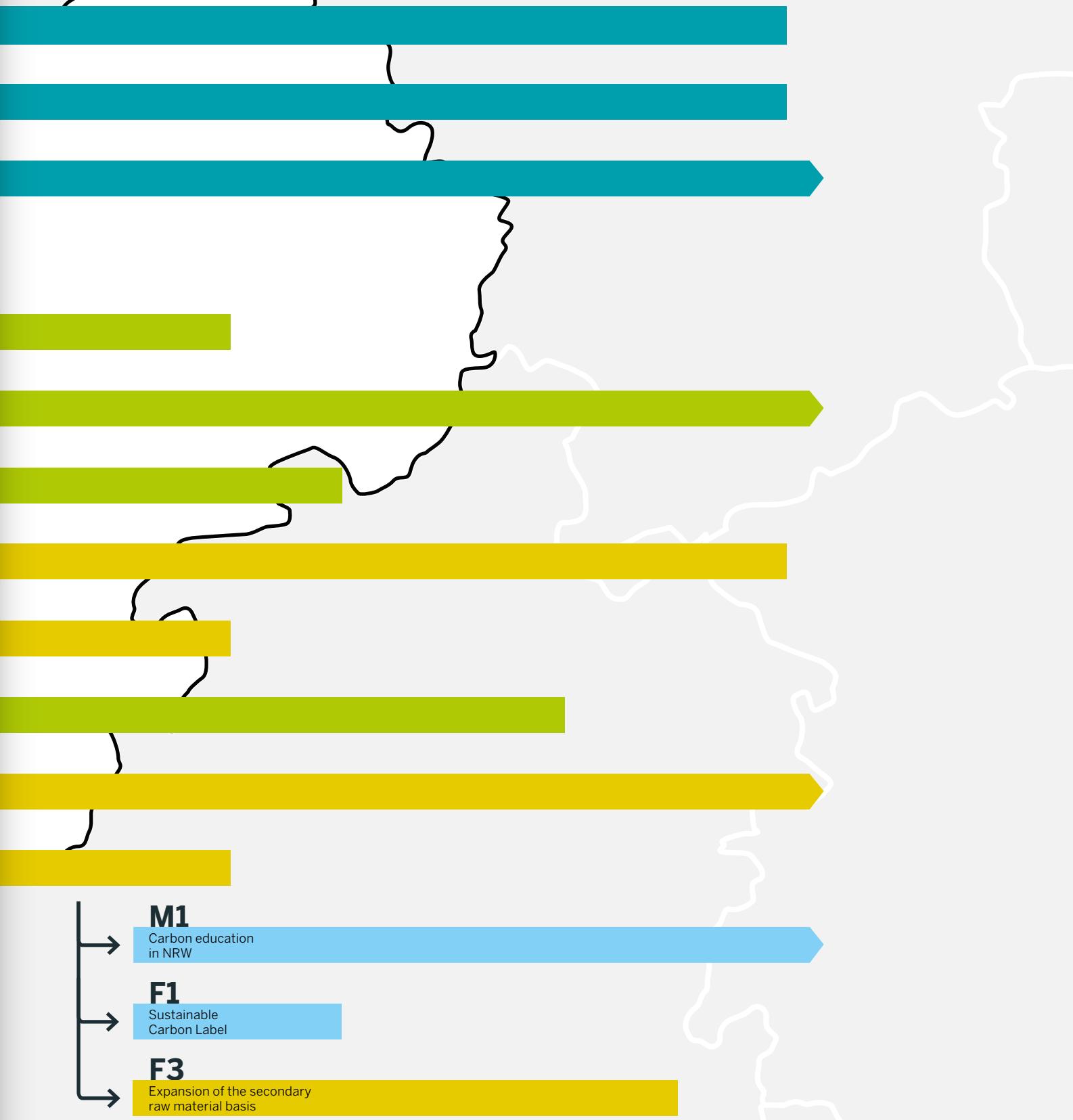
2027

2028

2029

2030

2045



Hesse

Space for notes

Glossary

This text is an extract from Carbon Management Strategy NRW. Carbon Management Strategy NRW, including all the sources upon which it is based, can be accessed at the following link:
<https://www.wirtschaft.nrw/carbon-management-strategie-nrw>

CBAM Carbon Border Adjustment

CCfD Carbon Contracts for Difference

CO₂ Carbon dioxide

CCS Carbon Capture and Storage

CCU Carbon Capture and Usage

CCX Carbon Capture, Transport, Usage and Storage

DAC Direct Air Capture

EU ETS European Union Emissions Trading System

IPCEI Important Project of Common European Interest

LCI Low Carbon Industry

OEM Original Equipment Manufacturer

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