

Decarbonisation roadmaps

We are committed to reducing emissions in line with the science required to limit global warming to 1.5°C above pre-industrial levels. To achieve this we need to reduce our emissions in line with our science-based targets by 2030 and ultimately become net zero by 2050.

In 2020, our 10 manufacturing sites with the highest emissions developed decarbonisation roadmaps to 2030. This involved firstly looking at each site's current energy requirements, identifying opportunities to decarbonise through energy use reduction, energy re-use and replacement with renewable energy. Sites then considered incremental improvements ranging from efficiency gains through to large transformational step changes such as replacement process technology. These opportunities have then been quantified, exploring the financial and carbon-reduction impacts of the proposed changes, ultimately forming a 10-year roadmap to decarbonisation for each site.

Employees at all sites have shown dedication and passion for Sustainability in helping us work towards our Commitment, especially Climate Positive. The roadmaps they produced will play a vital role in achieving our Climate Positive target.

Jon Elliott, Regional Technical Manager, Croda Inc. said:

"Working on the site decarbonisation strategies has been a great opportunity to shape the future of Croda. Previous discussions have been focused on small projects, but this wholesale review of operational site energy needs affords us the opportunity to look deep into the future and focus on more impactful changes. Workshops throughout the year helped us to understand best practice and put it into use to develop our site strategy."

Steve Brewer, Lead Engineer, Process Innovation Team, UK said:

"At the beginning of the year Croda gave me the opportunity to undertake an external sustainability qualification and it was enlightening to learn about the necessity to limit global warming to 1.5°C above pre-industrial levels, and the scale and pace of reduction in carbon emissions that Croda has to make to align with this objective.

"Initially, the task of rapidly decarbonising our production operations seemed quite daunting. The framework we developed to help with this involved breaking down the roadmaps into achievable tasks. I particularly enjoyed working with the sites on the third stage of the framework where decarbonisation opportunities were identified for each plant on that site. Now that the majority of our larger sites have produced decarbonisation roadmaps it is clear that, while it will require a sustained commitment to

delivering projects at all our sites over the next 10 years, Croda's decarbonisation ambitions are challenging but achievable.

"The process also gave some of our graduates the opportunity to contribute their fresh perspective to site decarbonisation as well as having the opportunity to learn about the sustainability challenges Croda and the wider chemical industry face."

“Working on the site decarbonisation strategies has been a great opportunity to shape the future of Croda.”

Jon Elliott
Regional Technical
Manager, Croda Inc

Shu Ying Tan
Graduate Trainee,
Croda Singapore

Steve Brewer
Lead Engineer,
Process Innovation
Team, UK

Shu Ying Tan, Graduate Trainee, Croda Singapore, said:

"The decarbonisation roadmap is how we plan for and look forward to a sustainable future together! It is an exciting and valuable experience to be involved in creating the roadmap, where we can improve current processes and explore novel technologies which may very soon become the norm for us. While building Singapore's roadmap and helping out with one for a site in China, I had the chance to work with colleagues from different departments and sites

as well as meet experts from different organisations. I have learnt a lot from them, and from these exchanges a valuable network of support between sites has been built. Despite the challenges presented by our ambitious targets, I find it reassuring that Croda is taking big steps in the sustainability movement, an indicator of our strong belief in ethical conduct and doing the right thing."



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Climate Positive

We will continue to reduce our carbon footprint and increase our use of bio-based raw materials, whilst the benefits in use of our ingredients will enable more carbon to be saved than we emit through our operations and supply chain.

Highlights

B

2020 CDP Climate Change score, recognising our management of climate-related risks and opportunities

67%

of our organic origin raw materials were bio-based in 2020, coming from renewable crops and biotechnology

839,220

tonnes of CO₂e will be avoided through the use of our products sold during 2020, as verified by Avieco

10 sites

prepared decarbonisation roadmaps, representing 90% of Group scope 1 and 2 emissions

Climate Positive by 2030

Objectives

Reducing Emissions:

We will achieve our science-based targets (SBTs) by reducing our emissions in line with limiting the global temperature rise to 1.5°C above pre-industrial levels, maximising the use of renewable energy in our operations.

Carbon Cover:

We will enable the transition to a low-carbon economy. We will be Climate Positive, working closely with our customers to develop products that offer carbon-saving benefits in use.

Sustainable Innovation:

We will accelerate the transition to bio-based products, moving away from fossil/petrochemical feedstocks.

Targets

- By 2030, we will have achieved our SBTs, in line with limiting global warming to 1.5°C
- Thereafter, by 2050 we will be a net zero organisation

- By 2030, use of our products will avoid four times the carbon emissions associated with our business-our 4:1 carbon cover

- By 2030, over 75% of our organic raw materials by weight will be bio-based, absorbing carbon from the atmosphere as they grow

Milestones

- A reduction of 25% in 2018 absolute scope 1 and 2 emissions by the end of 2024
- All Croda locations to have a decarbonisation roadmap by the end of 2022

- Two million tonnes of CO₂e emissions savings delivered through use of our products by the end of 2024
- 100% of our product portfolio evaluated for downstream scope 3 impact by the end of 2024

- 71% (rolling three-year average) of our organic raw materials to be bio-based by the end of 2024

2020 progress

- Our 10 manufacturing sites with the highest emissions have compiled decarbonisation roadmaps, highlighting opportunities to achieve the scope 1 and 2 emission reductions required to meet our SBTs

- We have established a carbon cover working group with cross-sectoral and regional representation to drive progress against this target

- The production of 100% bio-based surfactants has increased our use of bio-based raw materials by 4%
- Our Research and Development teams have introduced new ways of working to ensure our new products contribute to the achievement of our Commitment

SDGs



SDG 7.2



SDG 9.4



SDG 13.2



SDG 7.2
SDG 7.3



SDG 13.2



SDG 12.2



Reducing Emissions



Tackling the climate crisis is our biggest challenge, but through decarbonisation, innovation and customer collaboration it also offers us our greatest opportunities.

As a “Race to Zero” partner and signatory to the UN Global Compact’s Business Ambition for 1.5°C, we have committed to set a 1.5°C 2030 science-based target (SBT), and to become net zero by 2050. Once approved and published, which will be during the first half of 2021, our commitment to the SBTs will demonstrate leadership within our industry, with only two other companies in the chemical sector having 1.5°C approved SBTs. During 2020, we were invited to join the Science Based Targets Initiative (SBTI) Expert Advisory Group for the chemical sector. As part of this role, we have helped to develop understanding around the barriers, challenges and opportunities for chemical companies setting science-based targets.

Through collaboration we hope that others within our sector, which is recognised as hard to decarbonise, will join us in playing their part to limit global temperature rises to no more than 1.5°C above pre-industrial levels, helping to avoid the most catastrophic effects of climate change. We have moved towards alignment with the Task Force on Climate-related Financial Disclosures (TCFD) recommendations and have reported against the disclosures within this year’s Annual Report in advance of the

mandatory requirements. Further work will take place throughout 2021 to ensure we progress towards full alignment with the framework, including conducting scenario analyses.

Throughout 2020 we have been working with our 10 manufacturing sites that have the highest emissions, developing decarbonisation roadmaps to ensure we can achieve our ambitious targets globally (p12). We have set a milestone for all Croda locations to have completed a decarbonisation roadmap by the end of 2022. This year also saw us confirm, and start to implement, an internal carbon price of £50/tonne CO₂e for all capital expenditure proposals, we believe this will continue to drive the right investment decisions to meet the challenging targets we have set.

Whilst we plan our larger abatement projects, many of our manufacturing sites have already started to decarbonise. For example, this year our Incotec manufacturing site in Carrum Downs, Australia, underwent the first phase of a substantial upgrade to improve the sustainability footprint of its operations; with the installation of a 100kW solar energy system on the roof of the factory and office building. A further 50kW of solar panels will be installed in 2021.

Each site also ensures, wherever possible, they use low-carbon energy sources from their local area. For example, our manufacturing site in Chocques, France uses steam generated from

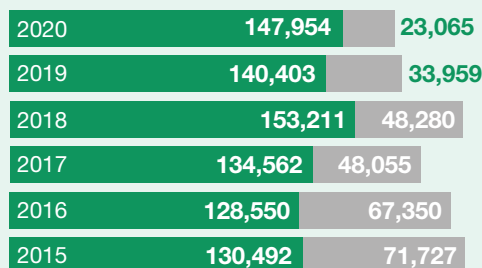
the incineration of local municipal waste. This year, as part of a replacement project for the waste plant, we have been able to secure continued access to this steam once the new plant is operational.

Scope 3 emissions

The majority of our emissions lie within our supply chain. This is mainly within the purchased goods and services category as carbon embedded within our raw materials. In 2021 we will have our scope 3 science-based target verified. Collaboration, engagement and encouraging suppliers to set their own emissions reduction targets will be key to us achieving our own target. In the 2020 CDP Supplier Engagement Rating assessing performance on governance, targets, scope 3 emissions, and value chain engagement we scored A-. We have set a milestone target that by the end of 2024, key suppliers representing at least 50% of our raw material volumes will sign up publicly to SBTi or equivalent carbon reduction targets.

The percentage of carbon within the supply chain increases as we move downstream towards our customers. As many of our key customers have also committed to science-based targets, our Commitment and decarbonisation targets will support them in achieving their own scope 3 reduction goals, with the cradle-to-gate carbon footprint of our products significantly reducing over this critical decade for climate action.

GHG emissions (TeCO₂e)¹



● Scope 1 ● Scope 2

Since 2015, our baseline year, our total scope 1 and 2 GHG emissions have reduced by 15.4%. Within this, our scope 1 emissions have increased by 13.3%, whilst we have seen a greater than 67% reduction in scope 2 emissions. Since 2017 we have been reporting market-based scope 2 emissions, which better reflect our purchasing of renewable electricity at greater levels than the national averages in the countries where we operate.

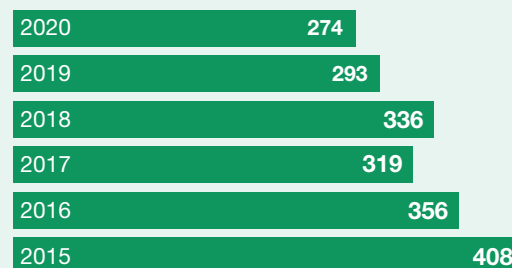
Scope 1 and 2 GHG emissions from our UK operations were 35,277 TeCO₂e in 2020 (2019: 34,932 TeCO₂e) representing approximately 20% of our global GHG emissions.

Energy consumption and efficiency improvements

In 2020 we consumed 1,113,064,125 kWh (2019: 1,026,316,451 kWh) of energy across our global operations. This included 223,177,222 kWh (2019: 223,465,355 kWh) consumed by UK operations. As part of our strategy to improve the efficiency of energy consumption, 27 projects were implemented globally, realising 31,642,487 kWh of annualised efficiency improvements, equivalent to 18,500 TeCO₂e avoided emissions.

1. Scope 1 emissions are calculated using Defra Government emission conversion factors for greenhouse gas company reporting. Scope 2 emissions are market-based (location-based by proxy for 2015 and 2016).

GHG emissions intensity (TeCO₂e/£m)



● Scope 1 and 2 emissions intensity

Our chosen measure of GHG emission intensity divides our GHG emissions (market-based scope 2 emissions) by value added², a measure of our business activity. Our 2015 baseline year, along with 2016, were calculated using location-based scope 2 emissions as a proxy. Since 2015, our GHG emissions intensity has improved by 33%, illustrating how we are decoupling growth from our environmental impact.

Our scope 1, 2 and 3 GHG emissions are verified by Avieco. Their formal independent verification statement is available at: www.croda.com/carbonverification.

2. Value added is defined as operating profit before depreciation and employee costs at 2015 constant currency.

Carbon Cover



Our ingredients offer many sustainability benefits in use, including helping our customers and their consumers to reduce or avoid greenhouse gas emissions. Through our Carbon Cover target our aim is that, by 2030, the use of our products will avoid four times the carbon emissions associated with our business. To achieve this target, we will:

- Discover and account for avoided emissions using our existing ingredients.
- Develop innovative, carbon-saving ingredients to meet our customers' needs.

“
By achieving this target, in 2030, the use of our products will be avoiding 3.8 million tonnes CO₂e per year, equivalent to removing the emissions associated with one coal-fired power plant for the whole year.”

In 2020 we identified several new Carbon Cover case studies for existing ingredients, quantifying the avoided emissions associated with their use. Our methodology for quantifying and reporting these avoided emissions is externally verified by Avieco.

Product case studies verified in 2020:

- PaddyRise™, a seed treatment product by Incotec, which increases the resilience of young rice plants to pests and diseases, resulting in a yield improvement. This reduces the carbon emissions intensity of rice production.
- Matexil™ LTW Textile, an additive used in fabric dyeing that enables processing at lower temperatures, resulting in energy savings.
- Veritas™, a biostimulant product by Plant Impact. This has been demonstrated to improve yields in soybean plants, leading to more efficient land use and in turn has associated carbon savings (see case study p20).
- Some of our by-products are sold as feedstocks for biofuels, used in place of petrochemical fuels. This offers a renewable route to generating energy avoiding emissions associated with burning fossil fuels (see case study below).

The total avoided emissions associated with ingredients from verified case studies was 839,220 tonnes CO₂e in 2020, which is equivalent to a carbon cover ratio of 0.8:1. Use of these products will also avoid 38.5 million m³ of water throughout their lifetime. This year, we have maintained our carbon cover ratio at 0.8:1 through the addition of new case studies. Avoided emissions associated with sales of our 2019 case studies fell slightly, primarily due to a slowdown in the automotive market, where our polymeric friction modifiers in engine oils provide significant emissions avoidance.

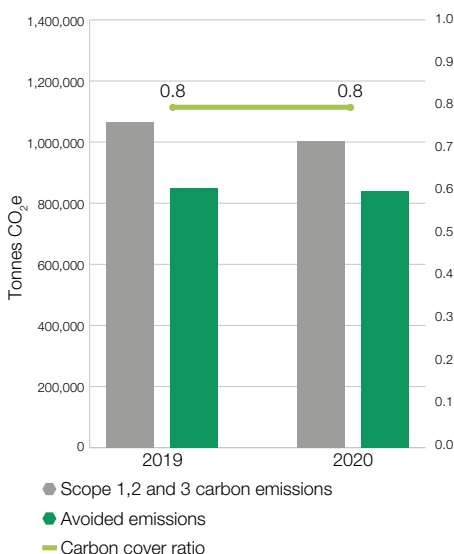


Improved yield reduces the carbon emissions intensity of rice production.

This highlights the importance of building up the carbon cover ratio for a much greater percentage of our product portfolio, which will help minimise the impact of differences due to changes in product mix and gain a more accurate picture of our true carbon cover. By the end of 2024 we will have evaluated 100% of our existing product portfolio for downstream carbon impact and will have accounted for two million tonnes of CO₂e avoided emissions.

Energised by the results of our verified case studies, we have in place a new Carbon Cover working group. The group will work to build our case studies and look to develop a methodology for us to identify avoided emissions for larger product/application areas, rather than individual product case studies. Having defined our new sustainable innovation ways of working for R&D (p16), carbon-avoiding potential is now evaluated for all new product launches.

Figure 1: Carbon Cover ratio



By-products for biogas and biofuels
Since 2006 we have been working with MBP Solutions who recover by-products from our manufacturing sites and repurpose them to sell for use in other industries. These by-products are derived from biomass and include wool grease, rapeseed oil and fish oil from our sites in the UK and the Netherlands. These are then repurposed by MBP for use as biogas and biofuels in energy production.

This biogas and biofuel can be used in place of petrochemical fuels such as diesel and natural gas, avoiding the greenhouse gas emissions associated with burning these fossil fuels. The bio-based nature of fuels made from our by-products means they are almost carbon neutral when used as a fuel, offering customers significant scope 1 emission savings.

Through working with MBP 13,800 tonnes of by-product was supplied as a biofuel feedstock in 2020. Using these biofuels in place of petrochemical alternatives, 31,000 tonnes of CO₂e has been avoided over the year. As well as contributing to SDG 7, by helping to scale up the supply of renewable energy, this collaboration also contributes to SDG 13 by improving how industries generate and use energy and in turn reduce their carbon footprint.

Additional destinations for our by-products include their use in animal feed, helping improve efficiency along the food value chain, as well as for agricultural fertilisers.

Sustainable Innovation



SDG Target:
12.2

In 2020, our use of bio-based organic raw materials increased to 67%; this is due to our bio-surfactants plant coming on-line in North America, displacing petrochemical-derived raw materials with those from bio-ethanol. Our 2030 target is for our use of bio-based organic raw materials to reach 75%, three times that of the target of the European chemical industry. Our interim target is to reach 71% on a rolling three-year average by the end of 2024. Bio-based raw materials sequester carbon from the atmosphere as they grow, so using them to displace fossil-based materials has a positive impact on the climate.

In order to progress further towards this target, our global Research and Development (R&D) team developed a database of bio-based raw materials, including those which we do not currently use. This database will broaden the range of bio-based raw materials that can be selected during new product development and will help increase the number of products in our portfolio that are 100% bio-based. A new cross-sector and multidisciplinary working group was established during 2020, with a purpose to identify new opportunities, through innovation and collaboration, to further increase our use of bio-based raw materials.

Our ECO range of Climate Positive surfactants

Our ECO range of 100% bio-based surfactants demonstrate the added value we can offer customers through our Commitment to be Climate Positive. In the image below, our Tween range of surfactants manufactured in North America is used as an example of this. Customers can immediately obtain a carbon reduction of 12% by switching to our bio-based Tween and will see this grow to 23% as the site reduces its emissions in accordance with our science-based target. This has the potential to reach a 71% reduction if we are able to move to sugarcane ethanol instead of corn ethanol.

Our Tween range of surfactants are sold as adjuvants through our Crop Protection business, increasing crop yields by improving pesticide efficacy, minimising land use and avoiding emissions associated with agricultural practices. As well as contributing to our Land Positive commitment, this will help us achieve our Carbon Cover target. If our Tween surfactants are included in formulations used on corn crops in the US, the raw material feedstock into our bio-surfactant plant will have a lower carbon and land footprint, with emissions savings passed on to our customers, demonstrating the circular nature and benefits of our Climate Positive commitment.

New ways of working in R&D

Over the past year significant progress has been made aligning the work of our global R&D teams with the SDGs. This began in November 2019, where we set ourselves the challenge to answer, “what do the SDGs mean to R&D?” From this, a small group began investigating how each of the 169 targets beneath the SDGs has an impact on innovation, showing us how we can better use the SDGs to direct our work in R&D. The team shared these findings externally in February 2020 where we also presented it to industry experts to challenge our thinking.

Each business unit then conducted a review of their current innovation projects using this new methodology. These reviews showed that, although we are doing well, more could be done to maximise sustainability outcomes within each project. This has led to the creation of our NP&D Sustainability Checklist, which sets out minimum criteria for new product development. The checklist allows our scientists to rate ongoing innovation projects against the SDGs and is supported by a guidance document with detailed explanations of each target, including how the targets translate internally, and criteria for meeting them. This checklist is a progression from our alignment with the 12 Principles of Green Chemistry, which has been embedded in our new product development for many years. The SDG targets used in the new



Tween™ used in crop protection





checklist have been mapped against the 12 Principles to ensure we have captured all elements of these important principles. Using the SDG targets helps R&D to align with our corporate ambitions, as well as providing a more holistic view of sustainability, particularly covering the extrinsic impacts of our products. This ensures consistency when reviewing sustainability criteria for NPD projects as well as ensuring accurate data for reporting against our targets.

Since the launch of our 2030 Commitment, and following the development of our NPD Sustainability Checklist, we have seen a shift in behaviour within our R&D teams. Sustainability is now a primary consideration during new product development and teams have an even greater drive to ensure sustainability is maximised in every new product that we create. This new way of working sees our R&D teams challenged to assess the impact of their projects and

ensure that they are contributing towards our Commitment to become Climate, Land, and People Positive. This new approach was integrated throughout our global R&D function through webinars and discussions with our R&D Sustainability Champions.

To understand how we can go beyond our existing ways of working to embed sustainability in all new innovations, Sarah Davidson, a graduate from our European Graduate Development Programme, was appointed to the new role of Sustainability Co-ordinator, Global R&D. This role was designed to give the function the support they need to drive activity to help us deliver our 2030 targets.

“To improve the impact of our products, sustainability needs to be built in during the design and development of new products-this is what R&D do! So we need to ensure our scientists have the skills and knowledge to incorporate sustainability into the innovation process. And this is what I aim to do in my new role.”

Sarah Davidson
Sustainability Co-ordinator, Global R&D



A positive sustainability impact: our new North American office and innovation centre

As part of our process for making new investments, we believe it is critical to consider how emissions can be reduced, and our sustainability impact maximised.

In February 2020, we started plans to relocate our North American office and innovation centre to Princeton, New Jersey. As part of our planning we completed a Sustainability Impact Assessment (SIA). This helped us understand the impact of the move from Edison, New Jersey to Princeton, which would include the relocation of some employees from other sites in the North East of the US. Social and environmental impacts were considered and an action plan to maximise positive sustainability impact was developed. The new facility will run entirely on 100% renewable electricity including site heating, therefore there will be zero carbon emissions associated with powering the site. Other features, including a state-of-the-art building management system and LED lighting will maximise energy efficiency and reduce overall energy requirements.

The new site will go beyond reducing carbon emissions, with many aspects incorporated into the design to maximise employee wellbeing. The space is bright, open and filled with natural light, as well as numerous plants to create a calming biophilic atmosphere. An on-site wellness room offers a space for nursing mothers or to enable quiet meditation. The site is located within a beautiful, natural environment, with trees and wildlife for employees to enjoy. Employee amenities include a fitness centre and on-site restaurant.

Recycling and minimising waste will be an important aspect of life at Princeton. Central recycling stations will be available and their use will be encouraged as there will be no desk-side bins. During the relocation, we recycled 20 tonnes of paper, and we plan to significantly reduce new paper use in Princeton. Recycling has been a key part of our office design with furniture chosen that incorporates recycled components, for example plastic bottles or recycled polyester, as well as choosing many items of furniture that are highly recyclable to eliminate waste when they near their end of life.

“We are pleased to be a flagship location for sustainability within the Croda organisation, keeping our Commitment to sustainability front and centre throughout all phases of the project. We’ve prioritised this in both large and small ways to deliver a facility created to inspire our teams and helping to deliver the ‘next gen’ green innovation to our customers.”

Cara Eaton
Marketing Director, Personal Care