GRI **Standard Numbers:** 305-5

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
2019 CDP Climate Change score, recognising our management of climate related risks and opportunities

63%
of our organic origin raw materials were bio-based in 2019, coming from renewable crops and biotechnology

850,500
tonnes of CO_2 will be avoided through the use of four of our products sold during 2019, as verified by Carbon Smart

28.5%
reduction in scope 1 and 2 GHG emissions intensity since 2015

Climate Positive by 2030

Objectives	Target	Next steps and definitions	SDGs
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.	• By 2030, use of our products will avoid four times the carbon emissions associated with our business, our 4:1 carbon cover	• Our carbon emissions calculation includes scope 1, 2 and 3 emissions (p22-23) • We have an auditable framework to report our avoided emissions, which are externally verified • We are integrating a carbon reduction/avoidance in use framework into all our innovation processes	7, 13, 17
Reducing Emissions: We will achieve our Science Based Targets (SBTs) by reducing our emissions in line with limiting the global temperature rise to 1.5ºC above pre-industrial levels, maximising the use of renewable energy in our operations.	• By 2030, we will have achieved our SBTs, in line with limiting global warming to 1.5ºC • Thereafter, by 2050 we will achieve net zero scope 1 and 2 GHG emissions	• We are working with South Pole Group to finalise our 2030 intermediate SBTs in line with limiting global warming to 1.5ºC (p23) • We will be rolling out an internal carbon pricing mechanism to support decarbonisation investments (p22) • All our locations are tasked with generating decarbonisation roadmaps, with priority given to those with the largest GHG emissions	7, 9, 13
Sustainable Innovation: We will accelerate the transition to bio-based products, moving away from fossil/petrochemical feedstocks.	• By 2030, over 75% of our organic raw materials by weight will be bio-based, absorbing carbon from the atmosphere as they grow	• Innovation programmes will be prioritised, wherever possible, on bio-based platforms (p24) • We are accelerating activity to identify and commercialise novel process technologies that allow increased bio-based raw material consumption • We will accelerate work to identify bio-based alternatives for all our petrochemical-derived raw materials	9, 12, 13

GRI **Standard Numbers:** 102-10

Carbon Cover

Inclusion of our ingredients into our customers' formulations can offer many kinds of benefit in use: social, economic and environmental. In 2019, we continued to quantify the avoidance or reduction in GHG emissions associated with the use of our products by customers or consumers in the end application. Our Product Sustainability sub-group of our Sustainability Steering Committee has played a key role in identifying examples from all around our business areas, demonstrating that our products have benefits in use across many markets. The aggregation of these individual product by product case studies will provide us with our overall carbon cover ratio. This is the amount of carbon that is saved through the use of our products, as a ratio of our organisational carbon footprint (scope 1, 2 and 3 emissions).

Carbon cover methodology and reporting

During 2019 we have worked with Carbon Smart to develop a methodology and reporting framework to allow consistent calculation and reporting of these benefit in use carbon savings. The framework ensures the benefit related to the inclusion of our ingredient is fully clarified and relevant literature sources are included, along with a rigorous data quality assessment. Using this framework, the carbon savings associated with the 2019 sales of products from four case studies have been externally verified.

The four product case studies verified in 2019 are:

- Coltide™ Radiance, an additive for fabric conditioner that reduces pilling and colour fade, extending the lifetime of clothes, avoiding carbon intensive clothing manufacture
- Perfad™ friction modifiers, an additive in engine oils that increases the fuel efficiency of vehicles
- Maxemul™ surfactants, these are used as emulsifiers in water-based paints enabling VOC reduction associated with solvents
- Priplast adhesive additives, these allow adhesion between composite and metal, enabling automotive lightweighting and increased fuel efficiency.

Total sales of these products into these applications led to a combined total of 850,500 tonnes CO_2 avoided, giving us a carbon cover ratio of 0.8:1.

In 2020, we will continue to work on further case studies for verification. To drive behaviour change and help us to meet our 2030 target, we will be calculating a carbon cover ratio for new products launched in 2020, and looking for market opportunities where our ingredients and technologies can help to reduce or avoid GHG emissions, and contribute to the fight against climate change.

Rewitec™ DuraGear

Wind turbines are a source of renewable energy, contributing to the decarbonisation of the global electricity grid. As with many mechanical systems, the gears in a wind turbine require lubricating. Over time the gears can deteriorate, and due to their inaccessibility maintenance is difficult, limiting a wind turbine's lifetime. Our 2019 acquisition Rewitec™ supply a gear conditioning agent for wind turbines, which, when added to the gearbox lubricant, helps to condition the gears and repair damage to gearboxes. This can avoid downtime associated with repairs, during which electrical demand would need to be made up by other sources, including fossil energy.

Manufacture of wind turbine parts is very energy intensive, as is carrying out repairs. Consequently, by decreasing the frequency of downtime, there are significant carbon savings from both an increase in renewable energy generated; and a reduction in new parts and repairs needed. Reducing the need for repair reduces frequency of wind turbine servicing which comes with considerable safety considerations. In addition to this, by increasing the lifetime of parts, which are integral to the performance of the turbine, it is possible to increase the overall lifetime of the turbine. This leads to further carbon savings from avoided emissions during manufacture and decommission of each turbine.

GRI **Standard Numbers:** 305-1, 2, 4, 5

Reducing Emissions

The chemical industry as a whole is challenged in playing its part in meeting climate change objectives for two reasons: it is predominantly fossil-based and it is energy intensive.

At Croda, we are different, being predominantly bio-based rather than fossil and targeting significant scope 1 and 2 reductions through conversion to green electricity and our in-house renewable energy initiatives including wind, solar, biogas and landfill gas.

We are one of the few companies within the speciality chemicals sector to commit to Science Based Targets (SBT). The SBT initiative is a collaboration between CDP, the United Nations Global Compact, World Resources Institute (WRI) and the World Wide Fund for Nature (WWF). It signals an acceleration in the transition to a low-carbon economy and supports companies who are already demonstrating they have the skills, expertise and ingenuity to make this a reality.

With reductions in GHG emissions a priority, in 2018 we established a Group target to achieve a 50% reduction in absolute scope 1 and 2 emissions based on 2006 levels by 2030 and an 80% reduction by 2050. These targets have now been superseded by our new and more demanding commitment to 1.5°C SBT by 2030, and to be net zero by 2050.

We are working with the South Pole Group to establish targets for scope 1, 2 and 3 emissions reductions. These will align with the requirements to limit the global temperature rises to 1.5°C above pre-industrial levels in order to prevent the worst effects of climate change.

We have already been working on initiatives across our manufacturing sites to reduce our emissions. As well as increasing our solar capacity, through new installations in Germany and North America, we have approved the installation of a large electric power cable to our Gouda manufacturing site in the Netherlands, in order to prepare for decarbonisation via electrification across several projects around the site.

Internal carbon pricing

To deliver on our 2030 Climate Positive Commitment, we are launching an internal carbon pricing (ICP) mechanism during 2020. Even though a small number of our operations are currently subject to external carbon-pricing policies and regulations, we are setting a monetary value internally for our carbon emissions that reflect possible future carbon prices outside the Company. Assigning a value to carbon will enable the right strategic choices and long-term decision-making at all levels, taking into account and helping us prioritise major projects that reduce our carbon emissions. It will also continue to fuel our innovation, using our smart science to meet our Group targets in this area. We are currently working out the exact mechanism we will choose and the price level to set, engaging with third parties to consider best practice in the industry.

GHG emissions

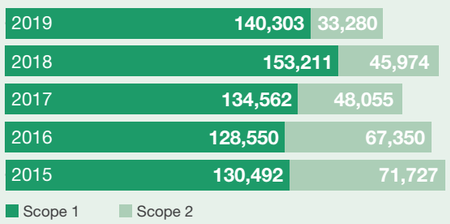
Since 2015, our baseline year, total scope 1 and 2 GHG emissions have reduced by 14.2%. Within this, our scope 1 emissions have increased by 7.5%, whilst we have seen a greater than 50% reduction in scope 2 emissions.

We have been reporting market-based scope 2 emissions since 2017, which better reflect our efforts in purchasing renewable electricity at greater levels than the national averages in the countries where we operate. We have seen a 67% increase in the absolute amount of non-fossil based scope 2 energy purchased between 2015 and 2019, now representing >70% of our indirect energy consumption.

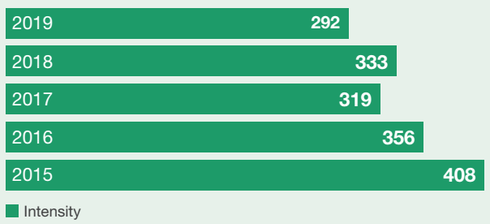
Our chosen measure of GHG emission intensity divides our GHG emissions (market-based scope 2 emissions) by value added[2]: a measure of our business activity. Our 2015 baseline year, along with 2016, were calculated using location based scope 2 emissions as a proxy. Since 2015, our GHG emissions intensity has fallen by 28.5%, illustrating how we are decoupling growth from our environmental impact.

Our scope 1, 2 and 3 GHG emissions are verified by Carbon Smart. Their formal Independent Verification Statement is available at www.croda.com/carbonverification

GHG emissions ($TeCO_2e$)[1]



GHG emissions intensity ($TeCO_2e$/£m)



1. Scope 1 emissions are calculated using the International Energy Agency's published conversion factors for the tonne equivalents of CO_2. Scope 2 emissions are market-based (location-based by proxy for 2015 and 2016).

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

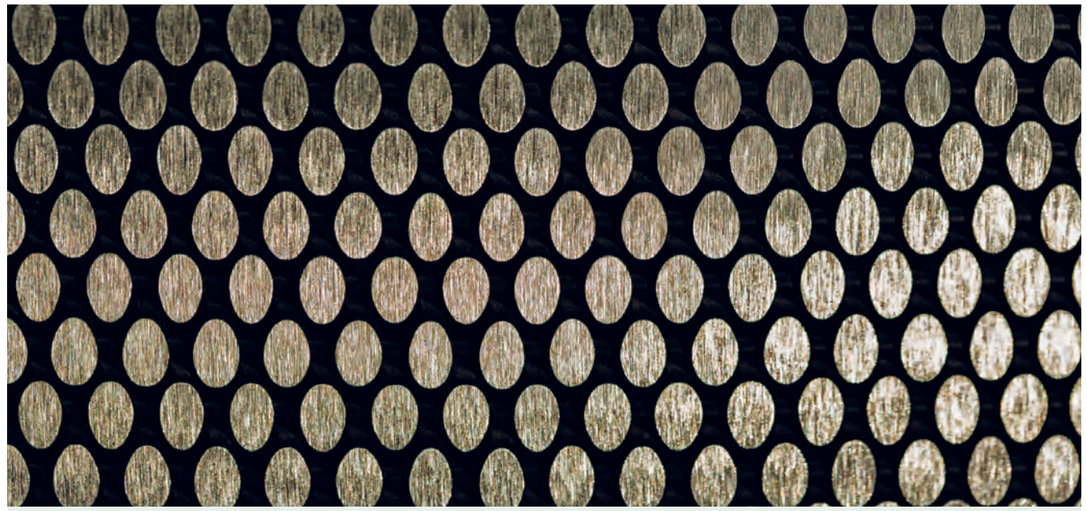
GRI **Standard Numbers:** 120-15, 305-3

Scope 3 emissions

The majority of our GHG emissions lie within our supply chain (scope 3) and we are working to reduce these, developing a scope 3 SBT, with the support of South Pole Group. This will be focused on our purchased goods and services, as the majority of our scope 3 emissions are embedded in the raw materials we use. As part of this, we will engage with key suppliers to obtain primary carbon emissions data. This will enable us to focus our efforts on carbon reductions associated with these major raw material streams.

Currently we use a hybrid model to report on our raw material scope 3 emissions, having developed impact tools for key raw materials to map the carbon footprint of our supply chains. For the remaining raw materials, we use a DEFRA spend factor.

In 2019, we invited 133 suppliers to respond to the CDP Climate Change questionnaire, through our CDP Supply Chain membership. We received a 43% response rate, with 56 suppliers submitting their questionnaire. 25 suppliers reported allocated emissions associated with the volumes of raw materials which we purchased from them during 2018, a 47% increase on 2017. This information helps us to build a more accurate picture of our scope 3 emissions based on primary data. Seven of our suppliers who responded have an absolute emissions reduction target. We will continue engagement with suppliers, encouraging them to carry out emissions reduction initiatives and set appropriate emission reduction targets.



Nanofiltration

We recently invested in new nanofiltration technology for a new application at one of our manufacturing sites. Initially targeted at reducing salt content in the final product, it also presented an opportunity for replacing high energy thermal evaporative technology at the site.

Nanofiltration membranes can retain the product whilst allowing water and salt to be removed from a solution under moderate conditions. This means that rather than using heat to concentrate a water-soluble product, we can use membrane filtration. This has a number of benefits including: lower energy requirements, fewer side products, less discolouration of thermally sensitive products and shorter batch concentration times.

To ensure all the benefits of using nanofiltration were identified, our Process Innovation Team completed a Sustainability Impact Assessment (SIA). This is a newly designed in-house methodology to consider the holistic sustainability impacts of a project. As part of our SIA process, several sustainability benefits were identified:

- The use of nanofiltration reduces steam, and therefore gas consumption, by up to 50%
- Improved health and safety impacts of production due to lower operating temperature
- Customers provided with improved product quality and consistency
- Increased capacity of the plant.

The methodology also identified risks with the technology to be considered, for which mitigations are being developed by the project team:

- Additional cleaning chemicals are required to keep the membranes in good condition
- Membranes can be damaged by particulates or extremes of pH, with exposure to these risks reducing membrane lifetime
- The membrane modules are made of multiple polymeric materials and are, therefore, not straightforward to recycle at end of life.

Our SIA process helped us to identify the key opportunities and risks in implementing this technology and is a useful tool in measuring the potential sustainability impact of a project. The tool demonstrated the project's alignment and positive impact towards several of the SDGs: 3, Good Health and Wellbeing, 7, Affordable and Clean Energy, 9, Industry, Innovation and Infrastructure and 13, Climate Action.

GRI **Standard Numbers:** 102-2, 301-1

Sustainable Innovation

The chemical industry must transition towards a bioeconomy, replacing fossil with bio-based raw materials and biotechnology. The RoadToBio* chemicals roadmap for the European chemical industry aspires to increase the share of bio-based raw materials from <10% to 25% of the total volume of organic raw materials used by 2030.

Our bio-based raw material feedstocks absorb carbon from the atmosphere as they grow, meaning that even after processing, some of our ingredients leave our manufacturing sites as carbon negative. During 2019, our raw material consumption comprised 94% organic and 6% inorganic origin. Within the organic origin raw materials, 63.3% were bio-based, a unique industry-leading position. Almost 30% of our turnover is represented by new, patented and protected products (NPP). With this level of constant innovation and working with our suppliers, we are targeting a 75% bio-based organic raw material consumption by 2030, 7.5 times greater than the industry average today and three times greater than its 2030 aspiration. We are working to identify bio-based alternatives for all of our petrochemical-derived raw materials and will continue to focus our research and development efforts on bio-based platforms.

* Published by Dechema, BTG, E4Tech, Nova Institute for Ecology & Innovation

ECO bio-based surfactants

Our new ECO range of 100% bio-based, 100% renewable non-ionic surfactants were voted the 'Bio-based Industry Story of the Year' and also received the 2019 Bio-based World News Innovation Award.

Reducing our reliance on petrochemical feedstocks, using an increased level of renewable energy and eliminating rail transportation of ethylene oxide are all part of our continued assessment of the total life cycle impact of our products.

Our ECO range lends itself to the USDA BioPreferred® Program*, with 131 ingredients listed versus our peer group average of just 17. Out of 3,247 companies registered with the USDA BioPreferred® Program across all industries, including ingredient suppliers and personal care consumer product companies, we have the fourth highest number of ingredients listed.

* USDA BioPreferred is a registered trademark of the US Department of Agriculture.

Our ECO plant at Atlas Point, North America

Crodamide ER is manufactured from rapeseed oil

Crodamide ER life cycle assessment

Crodamide ER is a polymer additive produced at our manufacturing site in Hull, UK. The raw material used in its production is rapeseed oil, sourced from rapeseed grown locally and shipped to the site via barge. A study of our supply chain has shown that this rapeseed oil has a carbon footprint of -1.71kg CO_2e/kg.

In 2019 we mapped the energy requirements to produce a batch of Crodamide ER. For this we used new Aspentech software, which allows live tracking of steam use across site. Our Hull manufacturing site is partly powered by its own 2.05MW wind turbine, and all purchased electricity is also from renewable sources. Using SimaPro software and following ISO 14067, we calculated the cradle-to-gate carbon footprint of Crodamide ER, proving that on leaving our manufacturing site in Hull, Crodamide ER is carbon negative, offering our customers a carbon saving on purchasing this bio-based ingredient from us. This study has been externally verified by Carbon Smart and is specific to our manufacturing process.