



# A Covestro carbon footprint study.

Industrial coatings applied on a metal substrate.



# A carbon footprint study on Covestro's powder coating resins

The world is facing tough challenges. With our global population continuing to rise and the world's middle class expanding, our demand of resources is expected to triple to reach 130 billion tons by 2050. In addition, our carbon emissions continue to drive climate change, which is having an increasingly harmful impact on both natural environments and human communities.

In view of these challenges, the private sector as a whole needs to deliver value for a wide stakeholder base – not just employees and customers, but the world's communities and the individuals who live in them. Chemical companies should pull their weight in the area of energy efficiency and innovation, recognizing environmental performance – alongside health, safety and security – as essential to business success.



At Covestro, we are driven to make a lasting and sustainable difference to the world we live in. We work hard to ensure that our innovations and products meet global needs.

In particular, we are a purpose-led global science-based company in Nutrition, Health and Sustainable Living. Covestro drives economic prosperity, environmental progress and social advances to create sustainable value for all stakeholders.

Covestro delivers innovative business solutions for human nutrition, animal nutrition, personal care and aroma, medical devices, green products and applications, and new mobility and connectivity. With approximately 23,000 employees, Covestro and its associated companies deliver annual net sales of about €10 billion. The company is listed on Euronext Amsterdam.

At Covestro, sustainability is our core value.

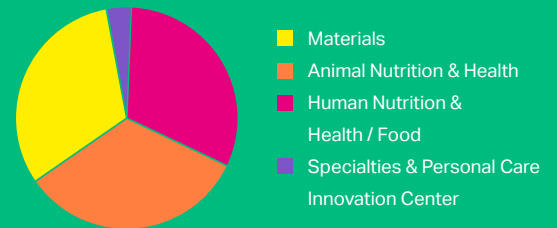
**We are focused on delivering science-based, sustainable and scalable solutions that address the challenges our world faces today, in line with the UN Sustainable Development Goals.**

We put great effort into managing sustainability and putting the right people, partners and processes in place to help realize our goals of a healthier planet, a fairer world, and sustainable and profitable growth.

**Specifically, we look after our planet and its communities by:**

- By performing studies to understand the environmental footprint of our products
- By developing solutions that reduce environmental footprints throughout the value chains in which we operate
- By continuously minimizing our environmental footprint; for example, by using energy and raw materials efficiently and using renewable resources where possible.

## Covestro at a glance (2018 numbers)



- Sales ~ €10 billion
- Adjusted EBITDA ~ €1.8 billion
- Global company with 65% of sales outside Europe
- Highly engaged workforce: ~ 23,000 employees
- Intrinsically innovative company: ~ 20% innovation sales (avg. last 5 years)
- 43% of sales to high-growth economies
- Strategy well aligned with the Sustainable Development Goals.

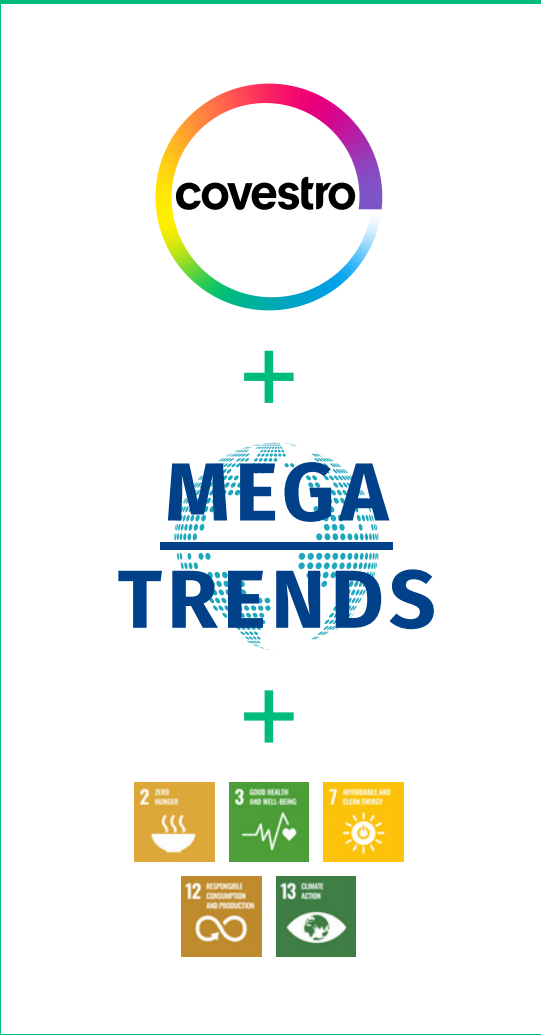


# Covestro's strategy:

Growth & Value – Purpose led,  
Performance driven.

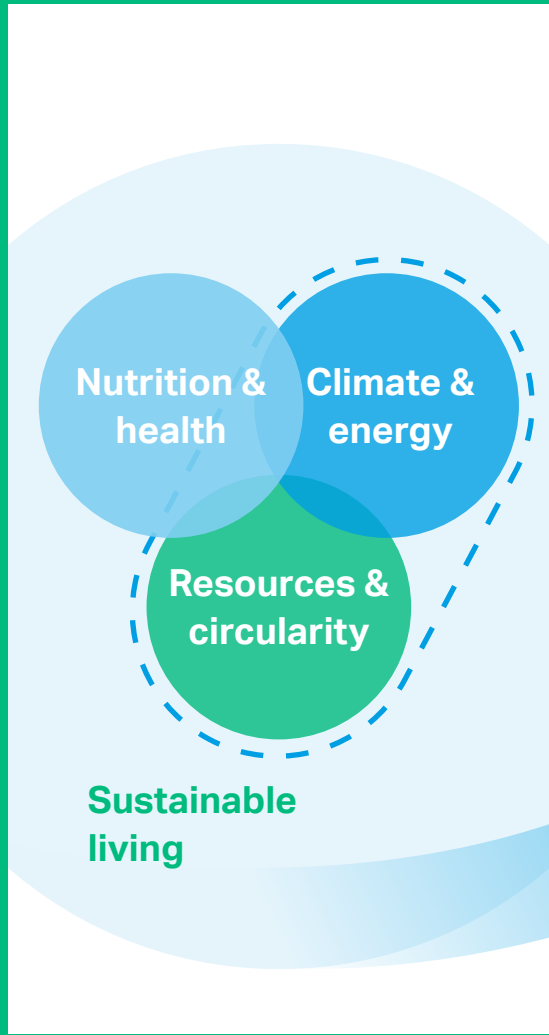
## Our competences and purpose ...

Covestro' key competences + addressing megatrends and the un sdgs:



## Provide growth opportunities in the focus domains ...

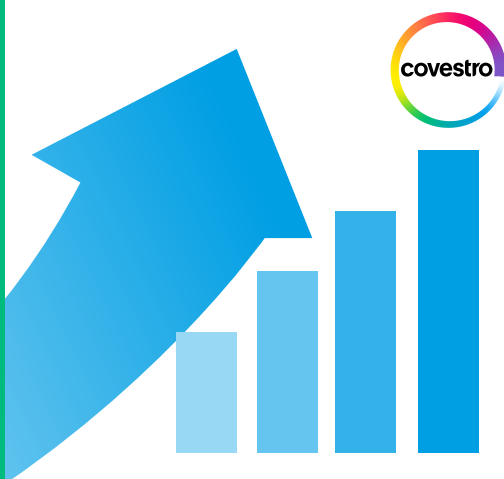
**A science-based company**  
in health, nutrition and sustainable living:



Creating a  
growth company ...



Company  
growth



With targets  
that underpin  
our mission.

Our 2019–2021 targets:

High single-digit %  
annual increase  
**adj. ebitda**

~10% average  
annual increase  
**adj. net operating  
free cash flow**



**Value-creating m&a**

**More information on our strategy  
can be found in the annex.**



Covestro sustainability targets  
**Climate & Environment**

Improving the environmental  
impact of our operations and  
the sustainability value of  
our portfolio

## 2020



**-40%**

Reduce specific emissions-to-air (VOC, SO<sub>2</sub>, NO<sub>x</sub>) by 40% compared to 2015.

## 2022



**Zero**

No landfill waste

## 2025



Insignificant VOC and SO<sub>2</sub> emissions.

## 2030



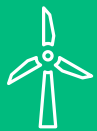
**-30%**

Reduce absolute greenhouse gas emissions (scope 1 & 2) by 30% compared to 2016.



**+15%**

Increase energy efficiency by 15% compared to 2015.



**75%**

At least 75% of purchased electricity is renewable in 2030.





## Covestro

Covestro is the global supplier of innovative high-quality resins solutions for paint and coatings, fiber optic coatings and 3D printing

**In particular, Covestro is a global leader in the development and production of sustainable coating technologies, offering waterborne, UV and powder coating resins with clear sustainability advantages over solvent-borne coatings.**

Leveraging our extensive experience and expertise in the technologies that are the building blocks for sustainable coatings products, a decade ago we decided to begin moving toward an alternative to solvent-borne solutions.



There are massive opportunities to reduce CO<sub>2</sub> emissions by replacing solvent-borne coatings with powder coatings and/or waterborne paints.



**There are different coating solutions for different applications. For a 1 mm-thick industrially coated flat metal substrate, we proved that:**



Powder coatings can produce the lowest carbon footprint



Waterborne paints also produce a low carbon footprint



Solvent-borne coatings typically produce the highest carbon footprint

# Powder coatings can help reduce CO<sub>2</sub> emissions

Solvent-borne coatings have a higher carbon footprint than powder coatings, as they typically require more paint to obtain equivalent coverage, and more energy for solvent evaporation and air heating.



## The study – CO<sub>2</sub> emissions

On a flat metal surface, powder coatings produce a much lower carbon footprint compared to other industrial coating systems. In particular, powder coatings reduce carbon emissions by between 10 and 55% compared to conventional solvent-borne coating systems.

## Covestro's innovation efforts in powder coatings

By far the most effective opportunity to reduce the carbon footprint of powder coatings at standard layer thickness is the reduction of layer thickness, followed by epoxy/hybrid replacement and lowering of curing temperatures and times. Covestro is investing substantially in all four areas of innovation, and will continue to do so.

Within powder coating resins, Covestro works to develop resins that possess the properties that will help us reduce the carbon footprint of powder coatings even further.

Powder coatings reduce carbon emissions by 10–55% compared to conventional solvent-borne coating systems.



## Powder coating reduces greenhouse gas emissions

If all solvent-borne coatings on metal applications in which currently powder coatings can be applied were replaced by powder coatings, then the greenhouse gas (GHG) emissions avoided would be equivalent to: the average annual carbon footprint of 1.5 million people in Western Europe or 2.9 million trips around the world in a car.

### Conversion to car kilometers

To convert savings to car kilometers, a well-towheel emission factor of 140g CO<sub>2</sub>-eq/km was used, as reported in an MIT study (Europe's Evolving Passenger Vehicle Fleet: Fuel Use and GHG Emissions Scenarios through 2035, KristianBodek& John Heywood, March 2008, Publication No. LFEE 2008-03 RP). For roundthe- world trips, a conversion factor of 40,000-km/trip was used.

### Conversion to people's footprint

To convert to people's footprint, the value for Dutch people for 2006 (10,500 kg CO<sub>2</sub>-eq/capita) was used as a representative sample from the United Nations Framework Convention on Climate Change (UNFCCC) data, as set on the Millennium Development Goals Indicators site of the United Nations ([mdgs.un.org](http://mdgs.un.org)).

### Covestro's powder coating innovation efforts are aimed at:



Reducing layer thickness



Epoxy and hybrid replacement



Lowering curing temperatures



Faster curing

# Powder coatings have great environmental benefits



For many years, users have enjoyed the economic and technical benefits of powder coatings. From the start, it was intuitively understood by users that these coatings had relatively low carbon footprints – a fact that was proved by Covestro’s first life cycle analysis in 2008. This assessment was reconfirmed in 2019 with a subsequent LCA study, which showed that powder coatings have an outstanding sustainability value.

**Building on our previous life cycle analysis (LCA) studies, our new study reconfirms that powder coating are among the most sustainable coating solutions.**

## Covestro aims at innovative and sustainable coating solutions

**Among the many other areas in which Covestro is involved, we are looking to develop sustainable solutions within the coating industry.**

Covestro has investigated the carbon footprint of the production and application of powder coating systems in comparison with typical liquid coating systems.

This report presents the results of our investigations for selected powder, solvent-borne and waterborne coatings.

## **Covestro’s innovation targets: sustainable coating solutions**

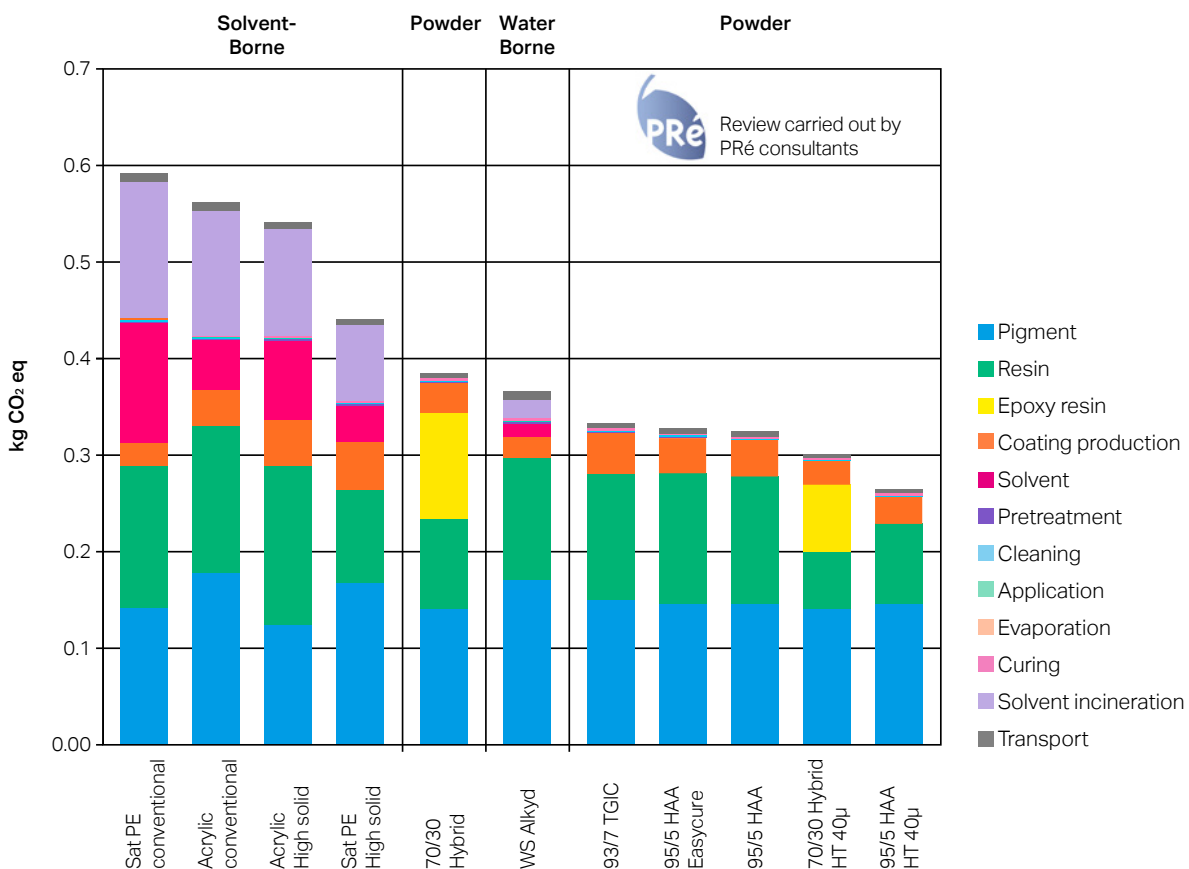
Within Covestro, the focus on innovation specifically includes sustainable coatings solutions. But how well, really, do we know the impact any coating has on the carbon footprints?

## Shaping powder

In our efforts to reduce the carbon footprint of our powder coating systems, we strive to lead the industry. Our research and development teams are continuously exploring ways to further improve the sustainability value of our powder coating solutions. Indeed, we are investing in further developing this technology for heat-sensitive substrates, which lies outside the scope of this LCA. By working in close partnership with our customers, our mission is to help shape the powder coatings industry as a whole.

### Together with Covestro, you can help reduce your carbon footprint through sustainable coating solutions:

- By using sustainable coatings throughout the value chain, together we can all help reduce your carbon footprint.
- By delivering the right raw materials, Covestro supports the development and growth of sustainable coating solutions.





## Covestro and LCA studies

Life Cycle Analysis is an objective process, based on state-of-the-art scientific insights, to identify and evaluate the environmental impact of a product or service over its entire lifecycle, or selected lifecycle phases. This is done by investigating material, energy and waste flows in to and out of the associated processes.

**The Covestro LCA Department strives to ensure the value of sustainability is realized at Covestro, by supporting decision-making in innovation and purchasing, and helping to leverage sustainability in the value chain through transparent measurement of the environmental and social impacts of our products and processes. External demands for more sustainable products also lead Covestro to set targets on sustainability. LCA helps to measure progress against these targets while identifying hot spots, supporting process/product design and preventing greenwashing.**

Covestro conducts LCA studies to maintain its high level of commitment to sustainability.

### **Covestro LCA methodology**

- SimaPro LCA software and ecoinvent database for environmental impact data
- IPCC GWP 2013 for carbon footprint
- ReCiPe 2008 for environmental impact
- Covestro internal LCA competence executing LCA
- Working with independent third parties



## LCA of 13 industrial coatings

**While the focus of this report is primarily on the carbon footprint of each of the examined coating systems, other environmental impacts will be presented in the study to expose the overall carbon footprint.**

The study covers the analysis of 11 coating formulations applied to 1m<sup>2</sup> of steel substrate. Coatings included:

### 1. Powder coatings for interior and exterior use

- 70/30 Hybrid
- 93/7 TGIC
- 95/5 HAA
- 95/5 HAA EasyCure
- 70/30 Hybrid HiTone (HT) 40μ
- 95/5 HAA HiTone (HT) 40μ

### 2. Waterborne industrial alkyd coating

- Water solvable (WS) Alkyd

### 3. Solvent-borne polyester and acrylic based coatings

- Saturated (SA) Polyester (PE) conventional
- Acrylic conventional
- Acrylic High solid
- Saturated polyester High solid

## LCA study for industrial coatings

**This LCA determines the carbon footprint of the resin and coating manufacturing process and the application of the coating on metal, and defines the CO<sub>2</sub> emissions of coatings applied on 1m<sup>2</sup> of metal.**

This analysis aims to compare the carbon footprint of powder coatings with those of common liquid coatings. The study includes impacts from cradle up to the application of the coatings onto a 1m<sup>2</sup>, 1mm-thick steel substrate. All raw materials used in the production of the resin binders and final coating formulations have been taken into account.

The application phase analysis includes, where relevant, the energy required to pre-treat and clean the substrate, apply the coating, evaporate solvents and cure the coating.

Incineration of solvents is assumed with the associated release of CO<sub>2</sub> from the combustion of organic materials. This assessment is intended for business-to-business purposes and, as such, does not include the full lifecycle of the studied products; use and end-of-life phases are excluded as they are considered equal in each case.

### This study\* includes:

- Resin production (both raw materials and energy)
- Coating production (both raw materials and energy)
- Coating application (solvent addition and energy)

\* The LCA Study was independently verified by PRé Consultants in March 2019.

The analysis does not include CO<sub>2</sub> emissions occurring upon destruction of the paint at the end of the service life of the coated object.

# Assumptions and methodology of the study

Assumptions	
<b>Industrial Metal</b>	Surface: 1 m <sup>2</sup> , flat Thickness: 1 mm
<b>Coating</b>	TiO <sub>2</sub> based white coating
<b>Carbon Footprint resin technology</b>	Assumed to be equal for all paints
<b>Pigment / Resin ratio</b>	Dependent on product formulation
<b>Curing Temperature</b>	180°C Powder (Uralac® EasyCure at 155°C) 150°C others
<b>Layer thickness</b>	40µ–60µ Powder 30µ others
<b>Overspray</b>	0% Powder 35% for solvent-borne and waterborne
<b>Drying temperature</b>	As defined per paint
<b>Solvent treatment</b>	Incineration
<b>Durability / functionality</b>	No differentiation



**Next to all of the above-stated assumptions, the following methodology was applied:** the carbon footprint was calculated using the IPCC 2013 GWP 100a assessment method, and the results are expressed as kg CO<sub>2</sub> equivalents using the associated characterization factors for the relevant greenhouse gases.

An assessment was made of each coating system, using the ReCiPe 2008 method to check for unexpected environmental impacts in categories relating to human health, ecosystem quality and resource depletion. None were found.

The LCA software SimaPro 8.5 has been used for this study. This software contains the Ecoinvent v3.4 database, which details the environmental profile of a large number of chemical processes and substances. We have used the data available from this database where possible, and defined our own where necessary.

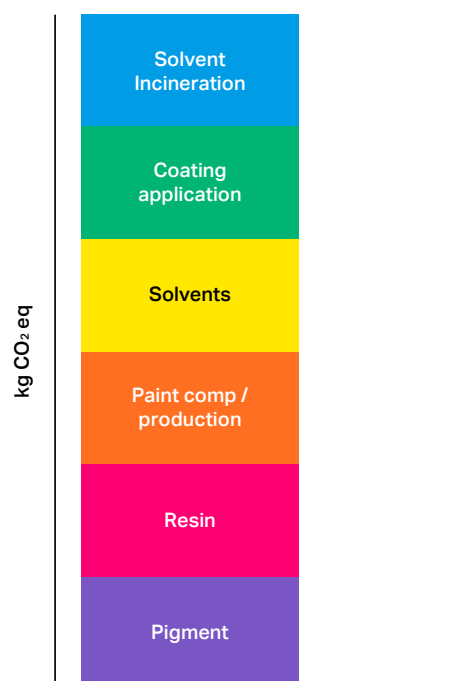




## Basic assumptions and parameters of this LCA study

1. The substrate is 1m<sup>2</sup> of 1mm thick steel.\*
2. The impact of energy to pre-treat and clean the substrate, apply the coating, evaporate solvents and cure the coating.
3. The CO<sub>2</sub> emissions from solvent incineration\*\*
4. To calculate the quantity of each coating required,\*\*\* the following parameters were taken into account:
  - a) Solids content
  - b) Pigment/binder ratio
  - c) Application thickness of cured, dried coating
  - d) Transfer efficiency
5. Specific weight of steel 7,800kg/m<sup>3</sup>, specific heat capacity of steel 438j/kg.oC.

**These coating components are investigated in the LCA:**



# Conclusions

## Covestro LCA study

There are different coating solutions for different applications for a 1mm-thick industrial-coated flat metal substrate.

- This second quantitative analysis again confirms that powder coating systems very likely produce the lowest carbon footprint.
- Waterborne paints also produce a the low carbon footprint.
- Solvent-borne coatings typically produce the highest carbon footprint.

Powder coatings can help reduce CO<sub>2</sub> emissions.

### The study – CO<sub>2</sub> emissions:

**On a flat metal surface, powder coatings produce the lowest carbon footprint compared to other industrial coating systems:**

1. Powder coatings applied in thinner layers generate approximately 0.3 kg CO<sub>2</sub> eq per m<sup>2</sup>.
2. Powder coatings at thicker layers and Waterborne paints generate 0.3–0.4 kg CO<sub>2</sub> eq per m<sup>2</sup>.
3. Solvent-borne and high solids (@30μ) coatings generate 0.44–0.6 kg CO<sub>2</sub> eq per m<sup>2</sup>.

Powder coatings reduce CO<sub>2</sub> emissions by 10%–55% compared to conventional solvent-borne coating systems.



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Edition: August 2021 · Printed in Germany