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DSM Carbon Footprint Study for Industrial Coatings applied on a Metal Substrate

Introducing DSM:

DSM is everywhere

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- **Located on five continents**
- **Approx. 22,700 employees**
- **Annual net sales of € 8 billion**
- **No 1 in Dow Jones Sustainability World Index**
- **Winner of 2009 Outstanding Corporate Innovator Award**

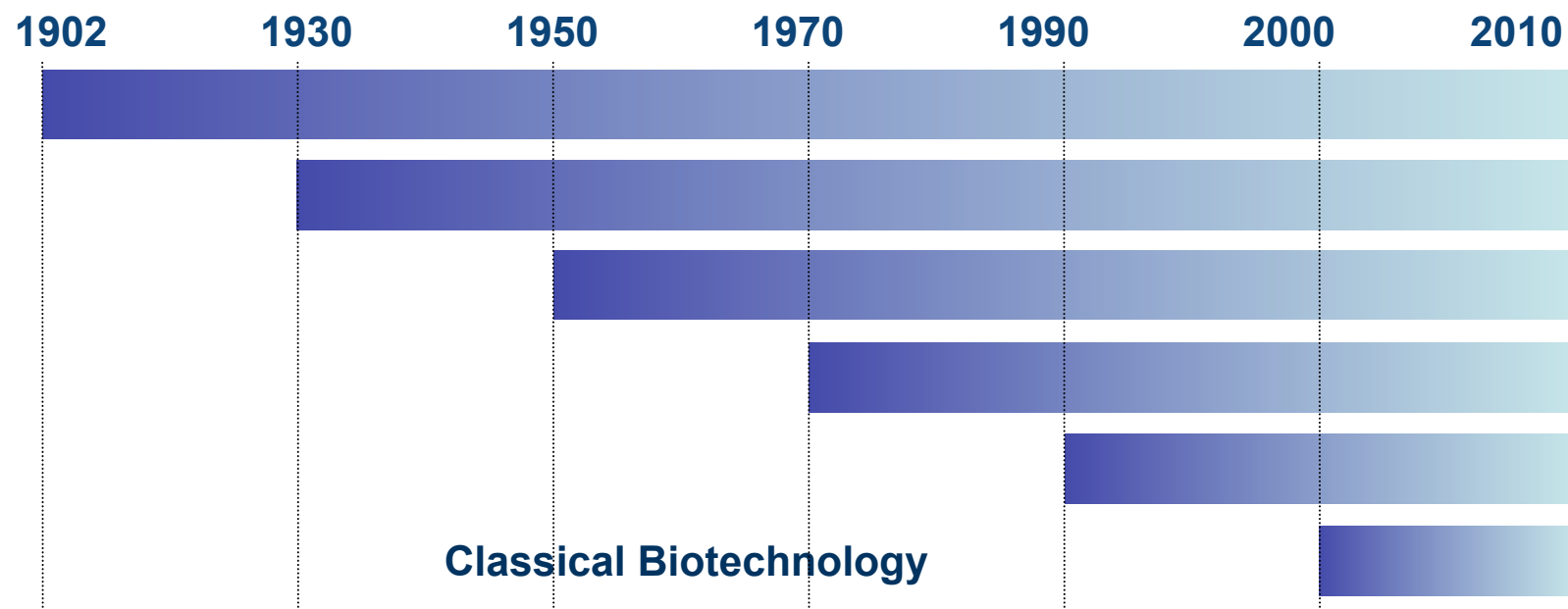
Royal DSM N.V. creates innovative products and services in Life Sciences and Materials Sciences that contribute to the quality of life.

DSM's Ability to change: *100 years of successful transformation*

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Coal Fertilizers Petrochemicals Performance Materials Life Science Products Biomaterials / Biologics



Technological competences

Mechanical engineering

Chemical engineering

Polymer technology

Material science

Fine chemicals

Modern Biotechnology

DSM and the Dow Jones Sustainability Index:



DSM is the No. 1 player in the chemicals market sector of the Dow Jones Sustainability Index

DSM takes responsibility for the Environment:

- As a company
- With the products it makes

DSM Sustainability Awards



World Business Council for
Sustainable Development



Dow Jones
Sustainability Indexes



FTSE4Good

Our world is facing serious challenges.

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If current consumption continues, we will need 2 globes by 2040(*)

- 
- Growing world population
 - Resource constraints: scarcity of food, land, materials

- 
- Carbon constraints
 - Over exploitation of global eco-system

* Source: WWF, Living Planet Report
October 2008

Climate Change and Global Warming force society to think and act differently.

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Policy makers and industry sectors across the world are working to understand their role and required actions.

**Sustainability
has never
been more relevant
than today!**

Chemical companies are aligning their innovation efforts to energy efficiency and overall environmental impact.

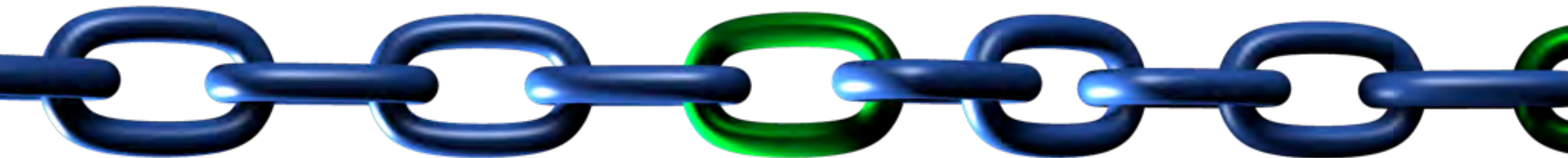
* Source: WWF, Living Planet Report October 2008

Many companies have already integrated Sustainability into their strategy. So has DSM.

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- Sustainability embedded in the company
- The eco-footprint throughout the value chain
- Leader in White Biotechnology
- Diverse workforce
- Responsible partner in society

DSM's sustainability is an integral part of its strategy



DSM conducts LCA* studies to maintain its high-level of commitment to Sustainability.



DSM LCA* methodology:

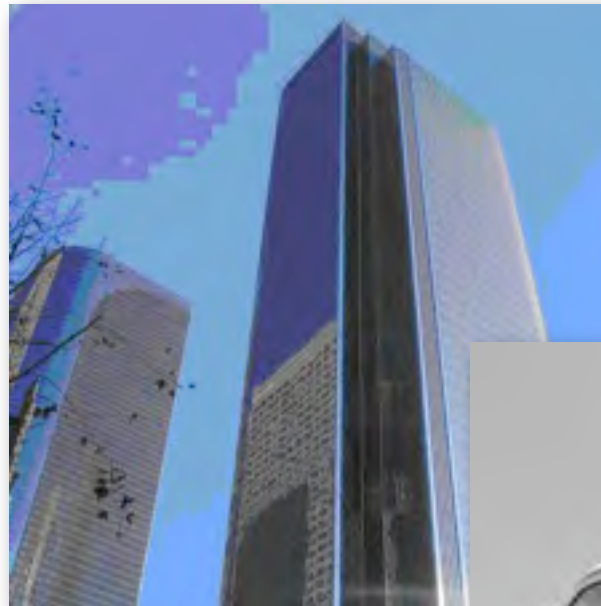
- SimaPro and EcolInvent database for environmental impact data
- Eco Indicator 99 for total Eco impact
- IPPC GWP 2007 for Carbon Footprint
- Own department for executing LCA
- Working with independent 3rd parties

* Life Cycle Assessment

DSM's Innovation Targets: *sustainable coating solutions*

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Coatings are all around us.



Within DSM's Performance Materials cluster, the focus on innovation includes sustainable coatings solutions.



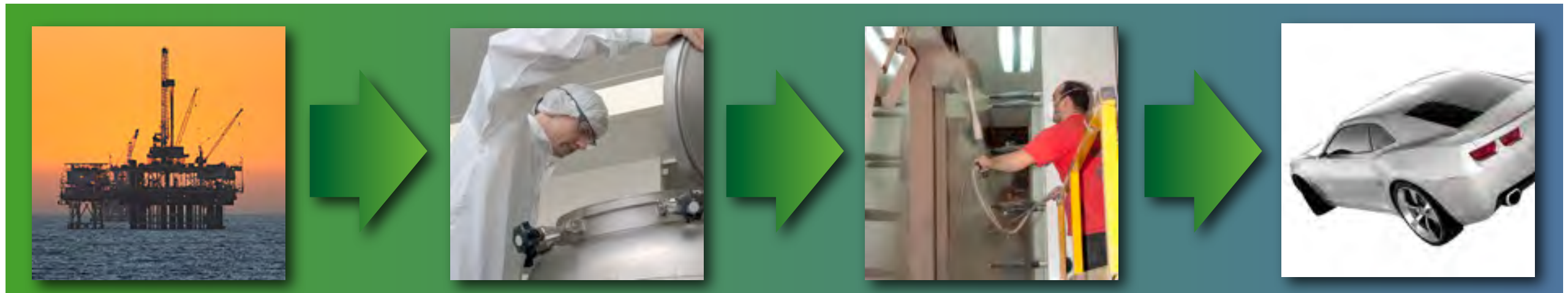
But how well, really, do we know how much impact any coating has on the Carbon Footprint?



DSM has conducted an LCA study for Industrial Coating systems.



This LCA determines the Carbon Footprint of the resin and coating manufacturing process and the application of the coating on metal, and defines the CO₂ emission of coating applied on 1 m² metal.



This study* includes:

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

★ Note: The study was verified and its results validated by CE Delft, an independent and objective third party, in conformity with PAS2050 Carbon Footprinting standards.



The coating formulations covered in this DSM study are:

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Powder Coatings *(for interior and exterior use)*

93/7
TGIC

Uralac®
EasyCure

95/5
HAA

70/30
Hybrid
HT 40μ

95/5
HAA
HT 40μ

70/30
Hybrid



Water-borne industrial alkyd coatings

WS
Alkyd



Solvent-borne polyester and acrylic-based high solids coatings

Sat PE
Conv.

Acrylic
Conv.

Acrylic
high
Solids

Sat PE
high
Solids



The coating formulations were analyzed on the basis of the amount of energy spent and impact on CO₂ emissions.

The analysis does not include the CO₂ emissions occurring upon destruction of the paint at the end of the service life of the coated object.

Assumptions:

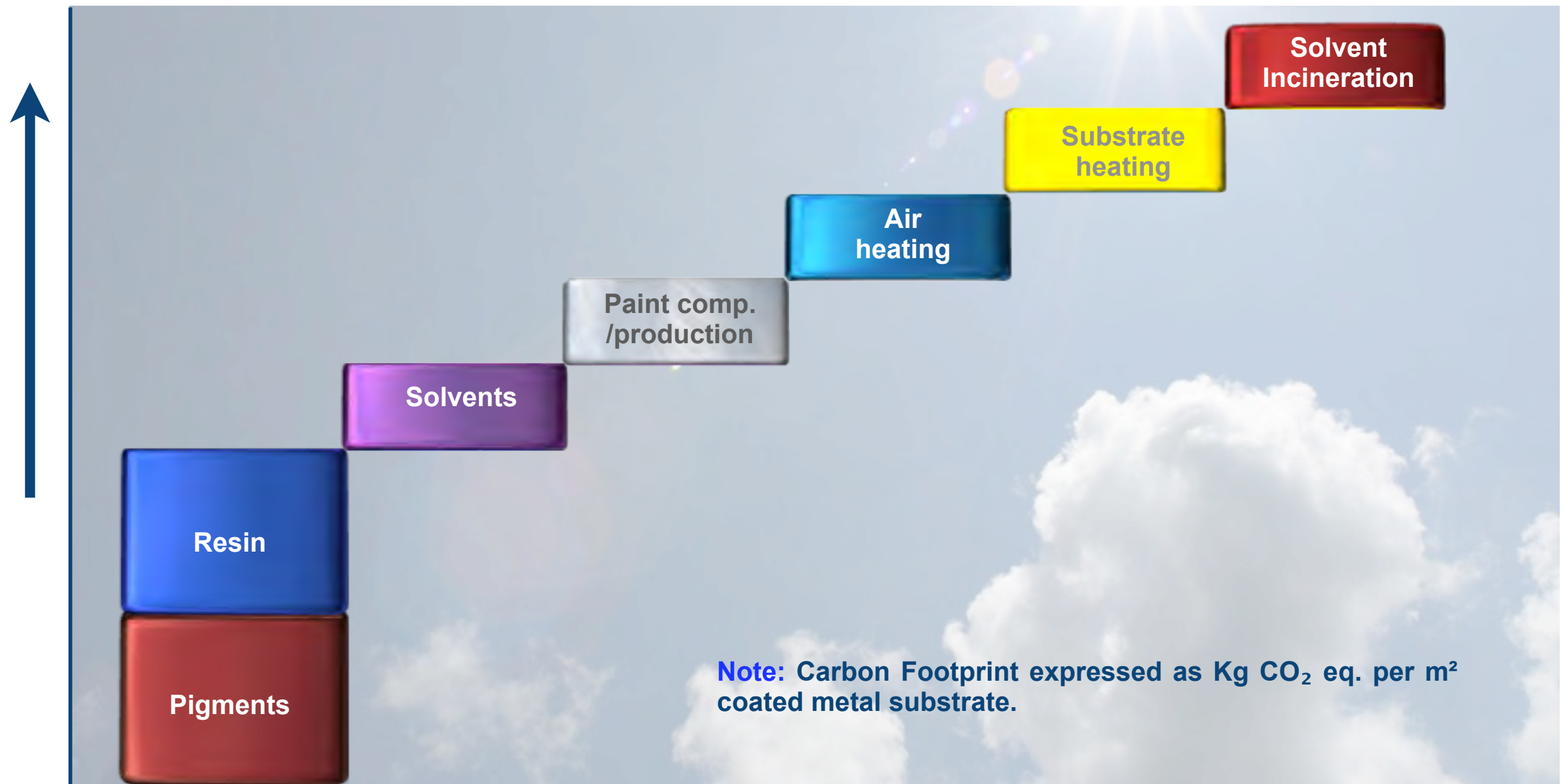


Industrial Metal	Surface: 1 m ² , flat Thickness: 1mm
Coating	TiO ₂ based white coating
Carbon Footprint Resin Technology	Assumed to be equal for all paints
Pigment / Resin Ratio Pigment	Dependent on product formulation
Curing Temperature	180°C Powder (Uralac® EasyCure™ at 155°C) 150°C others
Layer Thickness	40μ -60μ Powder 30μ others
Overspray	0% Powder 35 % for Solvent-borne and Water-borne
Drying Temperature	As defined per paint
Solvent Treatment	Incineration
Durability / Functionality	No differentiation

The components of the Life Cycle Analysis of Coatings:

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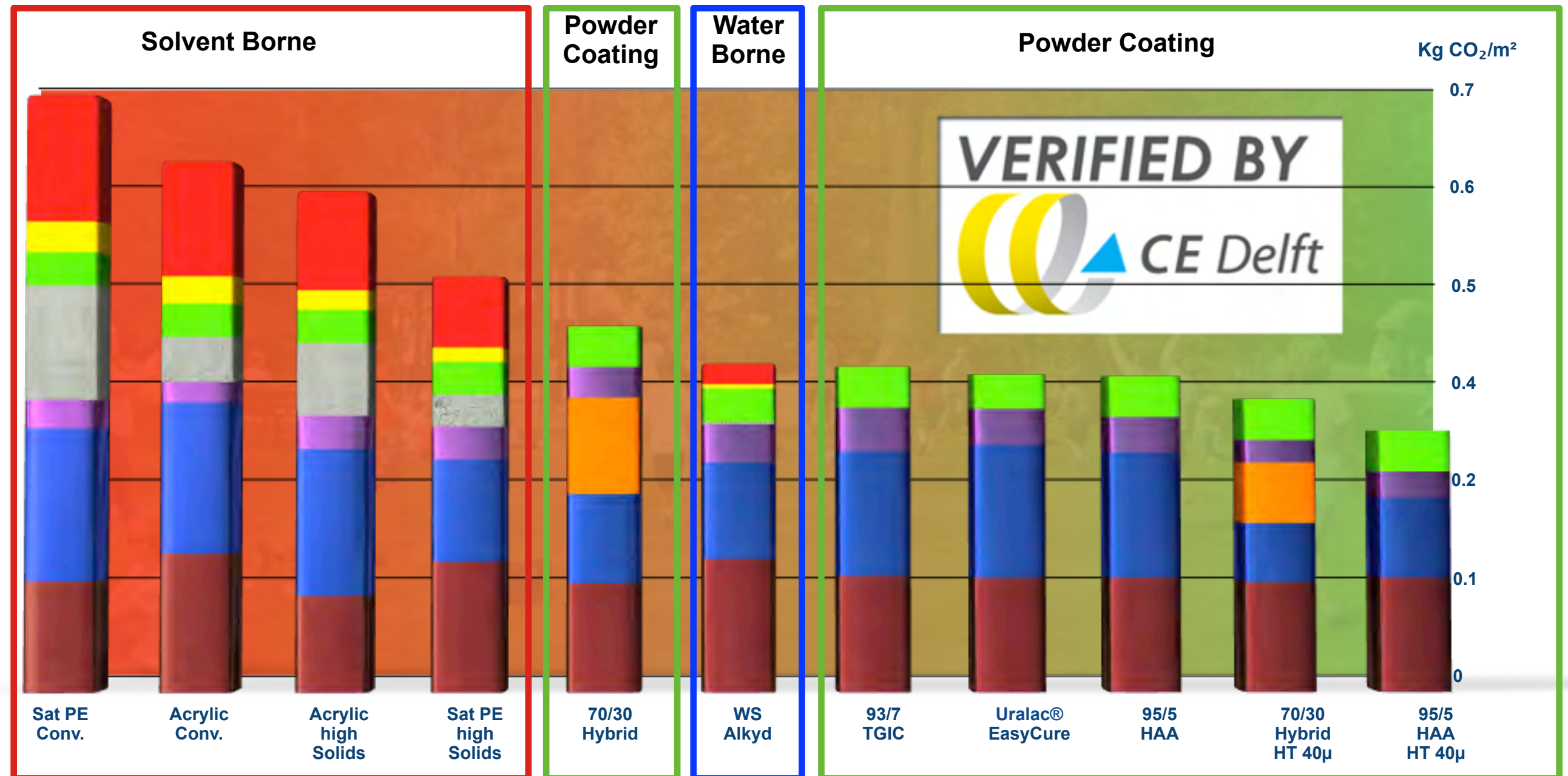
Kg CO₂ eq.



The results of the DSM study:



■ Pigment
 ■ Resin
 ■ Epoxy Resin
 ■ Coating production
 ■ Solvent
 ■ Substrate heating
 ■ Air heating
 ■ Solvent incineration



Note: Carbon Footprint expressed as Kg CO₂ eq. per m² coated metal substrate.

More than one sustainable coating solution:



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



Water-borne paints and Powder Coatings produce the lowest Carbon Footprint.



Solvent based coatings typically produce the highest Carbon Footprint.

Powder Coatings can help reduce CO₂ emissions.



THE STUDY - CO₂ emissions:

On a flat metal surface Powder Coatings produce the lowest Carbon Footprint compared to other industrial coating systems.

Powder coatings at thinner layers generate less than 0,33 kg CO₂ eq per m².

Powder coatings at thicker layers and Water-borne paints generate 0,35 - 0,41 kg CO₂ eq per m².

Solvent-borne and High Solids (@30μ) coatings generate 0,47 - 0,67 kg CO₂ per m².

Powder Coatings reduce CO₂ emissions by 25 – 60% against conventional solvent-borne coating systems.

Powder Coating reduces GHG emission.

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If all solvent-borne coatings on metal applications in which currently powder coatings can be applied would be replaced by powder coatings, then the Green House Gas (GHG) emissions avoided would be equivalent to:

the annual emissions of approximately 9.5 million cars

or

to approximately 2.9 million trips around the world in a car,

or

the average annual carbon footprint of 1,5 million people in Western Europe



Conversion to car kilometers

To convert savings to car kilometers a well-to-wheel emission factor of 140 g CO₂-eq/km was used as reported in a MIT study (Europe's Evolving Passenger Vehicle Fleet: Fuel Use and GHG Emissions Scenarios through 2035, Kristian Bodek & John Heywood, March 2008, Publication No. LFEE 2008-03 RP). For round the 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 CO₂-eq/capita) was used as a representative sample from the United Nations Framework Convention on Climate Change (UNFCCC) data set on the Millennium Development Goals Indicators site of the United Nations (mdgs.un.org)

DSM innovates to make Powder Coatings even more sustainable.

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THE STUDY - CO₂ emissions:

The Innovation efforts of DSM in Powder Coating Resins are mainly based on:

Reducing Layer Thickness

Epoxy and Hybrid Replacement

Lowering Curing Temperatures



DSM in Powder Coating Resins works to develop resins that possess the properties that will help us reduce the Carbon Footprint of Powder Coatings even further.

DSM has confirmed the long-held hypothesis that Powder Coatings are among the most sustainable coating solutions.



Next to the economic and technical benefits of Powder Coatings, the hypothesis has long been that Powder Coating Systems very likely produce the lowest Carbon Footprint.

This is the first quantitative analysis to confirm that statement.

Together with DSM, you can help reduce the Carbon Footprint through sustainable coating solutions.

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By using sustainable coatings throughout the value chain, together we can all help reduce the Carbon Footprint.

By delivering the right raw materials, DSM supports development and growth of sustainable coating solutions.

DSM is the only Global, Committed and Innovative Powder Coating Resins supplier.

Want to know more about this study?

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If you would like to know more about this study, or how much impact the coating formulation you use has on the Carbon Footprint, contact:

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Enabling you to make the right choices.



You can now assess your coating formulations in a way that is comparable across the industry.