

EVERYTHING YOU NEED TO KNOW ABOUT

# EMBODIED CARBON

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FIGURE 1.

# THE LIFE CYCLE OF A PRODUCT

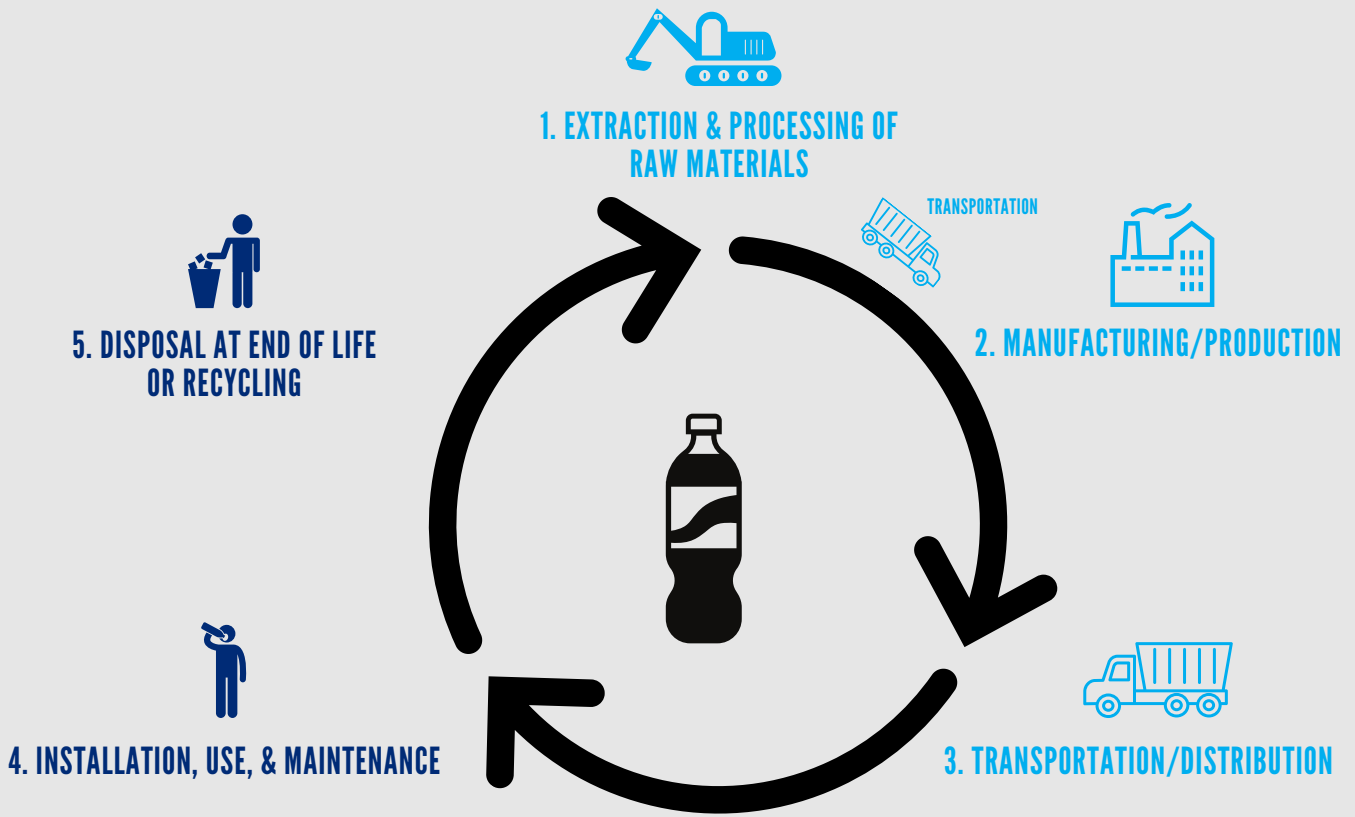
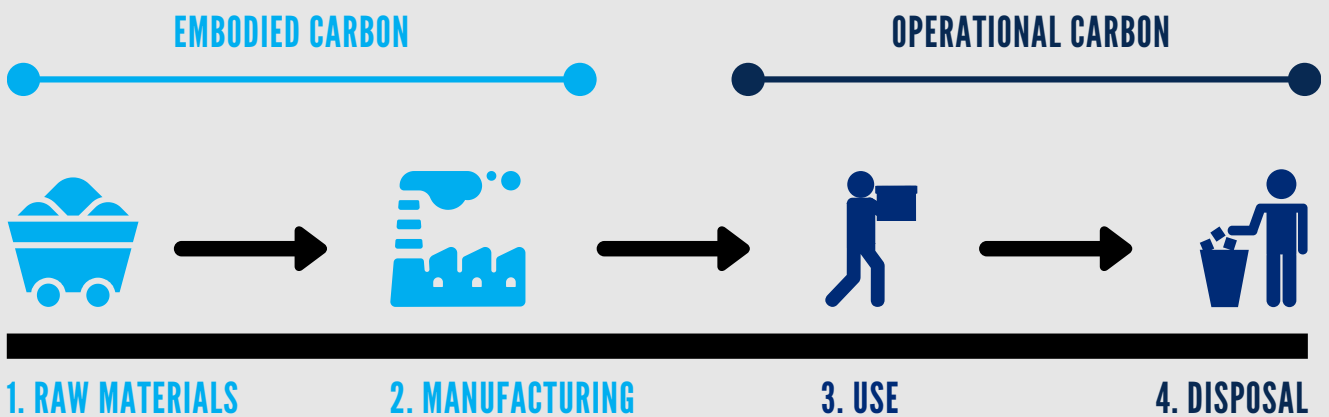


FIGURE 2.

# THE CARBON CYCLE FOR PRODUCTS



# WHAT IS THE CARBON CYCLE?

The carbon cycle, one of Earth's major cycles, is a system that is designed to recycle and reuse carbon atoms. When we manufacture products or consumer goods, we are using resources from the Earth that contain carbon such as fossil fuels and other raw materials. These resources are used in both the products and the creation of energy to manufacture the products. The total inflow and output of carbon-related emissions is known as the carbon footprint of a product. It is important to note that the carbon footprint of a product accounts for all greenhouse gases (GHG) emitted during the product's life cycle, not just carbon dioxide (CO<sub>2</sub>). A carbon footprint can also consist of methane (CH<sub>4</sub>), nitrogen dioxide (NO<sub>2</sub>), etc.

## STEPS 1 AND 2 IN FIGURE 2 MAKE UP THE EMBODIED CARBON IN A PRODUCT.

### 1. RAW MATERIALS:

Most of the raw materials used to make products are harvested from the Earth through processes such as mining, cutting down trees, and extracting fossil fuels. Many of these raw materials are then transported to facilities that will manufacture them into products. Embodied carbon in this step comes from the energy used to extract, process, and modify materials for use in a final product. The fuels that are used to transport these raw materials to the manufacturing facility also contribute to the embodied carbon of the product.

### 2. MANUFACTURING:

Once the raw materials arrive at the manufacturing plant, fuels and electricity are used in the facility to process the raw materials into the final product. All of the electricity, resources, and energy used during the raw material phase and manufacturing phases, including the transportation of the raw materials to the manufacturing facility, make up the embodied carbon of the product.

## STEPS 3 AND 4 IN FIGURE 2 MAKE UP THE OPERATIONAL CARBON IN A PRODUCT.

### 3. USE:

A product's carbon footprint in the use phase comes from products that consume energy over their lifetime such as refrigerators, cell phones, air conditioning units, and lightbulbs. For products that do not consume energy, their carbon footprint comes from the energy used for cleaning or maintenance. For example a carpet might need to be cleaned every year, and the clothes we wear need to be laundered regularly. Both of those processes use energy which contributes to the operational carbon of the product.

### 4. DISPOSAL:

A product's carbon footprint in the disposal phase comes from the energy used to recover the materials for recycling or to transport the product to final disposal (landfill, waste-to-energy, composting, etc.). All of the electricity, resources, and energy used during the use phase and the disposal phase make up the operational carbon of a product.



## WHY IS EMBODIED CARBON IMPORTANT?

To put things into perspective, a case study of a mid-rise office building in Seattle demonstrated that the embodied carbon of all the building's products accounted for 84% of the building's impact over a 50 year lifetime. Operational carbon only accounted for 16% of the building's impact over a 50 year lifetime. In the [Seattle case study](#), the operational carbon is especially low because hydroelectricity is the main energy source and energy code requirements are strict. In areas where the main energy source is coal or natural gas, the embodied carbon of a building usually accounts for about 50% of the building's impact over a 50 year lifetime.

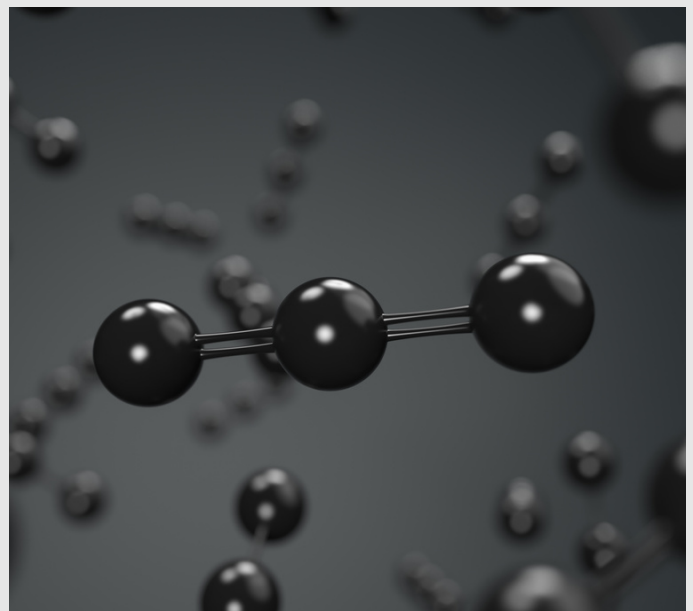
Understanding the embodied carbon in your product is done by conducting a Life Cycle Assessment (LCA) to identify the Global Warming Potential (GWP) of a product or process. GWP represents the total of all the GHG emissions in each phase of the product's life cycle. Once an organization understands the environmental impacts of the raw material and manufacturing stages for their product, they can develop a sustainable product innovation process with the goal of reducing the embodied carbon in both stages.

If more companies evaluate and understand the embodied carbon of their products, there could be a significant reduction in the GHGs emitted throughout the product life cycle.

## HOW CAN COMPANIES REDUCE EMBODIED CARBON?

Companies can reduce embodied carbon by:

- Sourcing raw materials from a closer location
- Integrating recycled content into their products
- Reducing the energy used to manufacture their products
- Using renewable energy
- Reducing materials used in their products
- Reducing packaging
- Creating product take-back programs or a closed-loop process



## EMBODIED CARBON, LEED, AND EC3 TOOL - BUILDING PRODUCTS

Leadership in Energy and Environmental Design (LEED) is a widely used green building rating system. LEED v4.1 provides credit for disclosing the environmental impacts of building products through an Environmental Product Declaration (EPD). Furthermore, LEED v4.1 provides credit for optimization where a product's embodied carbon is reduced. Below are the LEED credits that address embodied carbon:

- Materials and Resources: Building Products and Optimization - Environmental Product Declarations - Option 2 Multi-Attribute Optimization
  - Possible 1 point
- Procurement of Low Carbon Construction Materials Pilot Credit
  - Possible 2 points
- Circular Products Pilot Credit
  - Including: Supply Chain Circularity, Products Designed for Circularity, or Closed Loop Products
  - Possible 1 point

The Embodied Carbon in Construction Calculator (EC3) tool helps compare the embodied carbon of specific building materials.



## BENEFITS OF EMBODIED CARBON REDUCTION

The embodied carbon conversation started in the building products community, but it is important to consider the embodied carbon in **ALL** products. Every product has a carbon footprint that can be reduced. The benefits of reducing the embodied carbon in your products are:

- Reduced GHG emissions and energy consumption
- Cost savings from optimizing your products and processes
- Increased sales and competitive advantage
- Demonstrating your commitment to more sustainable products
- Stakeholder satisfaction
- Communicating your reduction achievements



# WORKING TOGETHER TO CONQUER CARBON

## CONQUERING CARBON:

### A Roadmap to Reduce Your Embodied Carbon

Sister companies, Sustainable Solutions Corporation (SSC) and GreenCircle Certified know how challenging it is to measure and reduce your product's embodied carbon. We put together a roadmap that will guide your organization to significantly reduce your embodied carbon in a transparent manner.

#### 1 BASELINE & BENCHMARK

SSC collects data and conducts any necessary site visits to benchmark and establish baseline data for manufacturing operations, as well as supply chain and raw materials. This data includes energy, water, waste, emissions, and packaging materials.



#### 2 CONDUCT LIFE CYCLE ASSESSMENT

SSC conducts a Life Cycle Assessment (LCA) to identify hot spots, assess the greatest impact drivers, and identify recommendations for improvement for your product and operations. SSC will present the findings from the LCA and identify opportunities for embodied carbon reduction.



#### 3 DEVELOP DOCUMENTS

SSC helps you transparently disclose the LCA information if desired. This can include the development of Environmental Product Declarations (EPD), product fact sheets, and ISO compliant LCA reports.



#### 4 PUBLICATION & TRAINING

SSC assists with the publication of LCAs, EPDs, and product fact sheets to transparently communicate the embodied carbon of your products. SSC trains sales and marketing teams, as well as new product development teams, on how to utilize the information from the LCA.



#### 5 OPTIMIZATION

SSC supports optimization through the implementation of recommendations for improvement. SSC utilizes our proven process for a Sustainable Product Innovation (SPI) program that you can integrate into your new product development (stage-gate) process.



#### 6 TRANSITION TO GREENCIRCLE

You will be introduced to the GreenCircle team who will guide you through our proven certification process. GreenCircle Certified is an unbiased third-party certification company and a completely separate business entity from SSC.



#### 7 CERTIFY YOUR SUCCESS

A designated GreenCircle certification analyst seamlessly guides you through the process for the most transparent certification. GreenCircle will collect and audit documentation to verify your claim, with the goal of certifying your optimization achievements.



#### 8 MARKET YOUR ACHIEVEMENTS

Tell your sustainability story with the help of GreenCircle's creative marketing team. Our marketing team offers support that is included in every certification, such as sales team education, coordinated press releases, a client profile on our Brands You Can Trust website page, social media posts, etc.



## OPTIMIZE YOUR PRODUCTS TO DECREASE EMBODIED CARBON THROUGH LCA AND SPI

Sustainable Solutions Corporation (SSC), offers two essential services to optimize your products and decrease your embodied carbon. These services are Life Cycle Assessment (LCA) and Sustainable Product Innovation (SPI).

LCA is used to understand the impacts of a product across its life cycle. LCAs can be used to meet green building requirements, transparency initiatives, and as a critical tool for designing more sustainable products.

The SPI process is embedded into a company's stage-gate or new product development process and enables product teams to consider alternative materials, processes, sourcing, and other aspects of a product.

## THIRD-PARTY CERTIFICATION TRANSPARENTLY DISCLOSES YOUR EMBODIED CARBON REDUCTION

GreenCircle Certified has multiple certifications that support optimized products and reduced embodied carbon. These include our Life Cycle Assessment Optimized certification, our Recycled Content certification, and our Closed Loop Product certification. By completing these various certifications, GreenCircle verifies and certifies claims that life cycle impacts of products were reduced as a result of implemented changes to the product based on previous LCA data.



# GREENCIRCLE'S CERTIFIED ENVIRONMENTAL FACTS (CEF) LABEL ADDRESSES EMBODIED CARBON REDUCTION

Every attribute on our label is third-party verified in accordance with applicable standards and are specific to your product and operations.

Certified Environmental Facts®	
Company:	Company
Product:	Product Name
Facility Location:	Facility Location
Certification Period:	Month X, 20XX - Month XX, 20XX
Certification Number:	XX-XXXX
<b>Product Specific:</b>	
Total Recycled Content <sup>1,2</sup>	%
Pre-Consumer:	%
Post-Consumer:	%
Regional Raw Material Sourcing <sup>3</sup>	%
<b>Product Optimization<sup>4</sup></b>	
Embodied Carbon Reduction <sup>5</sup>	%
2013 (kgCO <sub>2</sub> eq per yd <sup>2</sup> )	
2017 (kgCO <sub>2</sub> eq per yd <sup>2</sup> )	
Acidification Reduction	%
Eutrophication Reduction	%
Smog Potential Reduction	%
Carbon Neutral <sup>6</sup>	Yes
Take Back Recycling Program <sup>2</sup>	Yes
Closed Loop Product <sup>7</sup>	%
Biobased	0%
Recyclable <sup>8</sup>	0%
Published Environmental Product Declaration (EPD)	
Low-Emitting Materials	Green Label Plus
<b>Material Ingredient Reporting:</b>	
Verified Manufacturer Inventory (MIR) <sup>10</sup>	
Verified Health Product Declaration (HPD) <sup>10</sup>	
Verified Declare Label <sup>10</sup>	
<b>Manufacturing Specific<sup>11</sup>:</b>	
Carbon Emissions Reduction <sup>12</sup>	0%
2013 (total metric tonnes CO <sub>2</sub> eq):	
2018 (total metric tonnes CO <sub>2</sub> eq):	
Carbon Emissions Neutral	Yes
Energy Usage Reduction	0%
2013 (total MJ):	
2018 (total MJ):	
Renewable Energy Usage <sup>13</sup>	0%
2013 (total MJ):	
2018 (total MJ):	
Water Usage Reduction	0%
2013 (total gallons):	
2018 (total gallons):	
Outgoing Waste to Landfill Reduction	0%
2013 (total lbs):	
2018 (total lbs):	
Waste Diversion from Landfill <sup>14</sup>	%
ISO 14001 Certified	Yes
ISO 9001 Certified	Yes
Baseline Period:	Month 20XX - Month 20XX
Evaluation Period:	Month 20XX - Month 20XX
For more information on the Certified Environmental Facts of this product, please contact: <a href="mailto:info@GreenCircleCertified.com">info@GreenCircleCertified.com</a> , <a href="http://www.GreenCircleCertified.com">www.GreenCircleCertified.com</a>	
* Attributes in green contribute to LEED v4 and v4.1 credits.	
1. The minimum pre-consumer, post-consumer, and total recycled content across all product recipes is listed.	
2. This meets the requirements of LEED v4 and v4.1 MR Credit: Sourcing of Raw Materials.	
3. Raw materials sourced from tier one suppliers within a 500-mile radius of the manufacturing facility.	
4. This meets the requirements of the LEED Materials and Resources Building Product Disclosure and Optimization – Environmental Product Declaration and Multi-Attribute Optimization. This contributes two products or 200% of material cost under LEED v4.1.	
5. Product carbon footprint is based on a product recipe calculated using the sales-weighted average for yarn weight. Scope is cradle-to-gate.	
6. Made carbon neutral using retired carbon offsets. BV North America conducted an independent audit of the GHG Protocol Product Standard Report. The scope is raw material extraction to disposal.	
7. This meets the requirements of the LEED Circular Products Pilot Credit.	
8. Percentage indicates internal recyclability. Product may be 100% recycled at end-of-life in certain infrastructures.	
9. This meets the requirements of LEED v4 and v4.1 MR Credit: Building Product Disclosure and Optimization - Environmental Product Declarations. This attribute contributes 1 product under LEED v4 and v4.1.	
10. This meets the requirements of LEED v4 and v4.1 MR Credit: Building Product Disclosure and Optimization - Material Ingredients. This attribute contributes 1 product under LEED v4 and v4.1.	
11. All reductions benchmarked to production. Third-party review of manufacturing reductions contributes to optimization.	
12. Scope 1 and 2 emissions only. Carbon emissions reductions and total metric tons of CO <sub>2</sub> eq calculated using a market-based approach and financial instruments.	
13. Includes purchase of wind RECs and purchase of directed biogas.	
14. Includes both hazardous and non-hazardous material streams.	
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RECYCLED CONTENT

EMBODIED CARBON REDUCTION

CARBON NEUTRAL

BIOBASED

CARBON EMISSIONS REDUCTION

CARBON EMISSIONS NEUTRAL

ENERGY USAGE REDUCTION

RENEWABLE ENERGY USAGE

WATER USAGE REDUCTION

OUTGOING WASTE TO LANDFILL REDUCTION

WASTE DIVERSION FROM LANDFILL

Every attribute for building products in **green font** contributes to a LEED credit. Specific LEED credits are called out in the footnotes on the label.



# GREENCIRCLE'S CERTIFIED SUSTAINABILITY FACTS (CSF) LABEL ADDRESSES EMBODIED CARBON REDUCTION

Similar to our CEF label, every attribute on our CSF label is third-party verified in accordance with your specific industry and product. Our CSF label is designed to tell your complete sustainability story by not only capturing your environmental efforts, but also your social responsibility efforts.

## Certified Sustainability Facts™

**Company:** Company Name  
**Product:** Product Name  
**Facility Locations:** Facility Location

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**Product Specific:**

No Antibiotics

No Added Hormones

Vegetarian Diet 100%

No Preservatives

No MSG Added

Carbon Neutral

**Carbon Footprint Reduction - Per Unit of Product**

2016 %

2017 %

**Water Usage Reduction - Per Unit of Product**

2016 %

2017 %

**Animal Welfare Specific:**

Adequate Food & Water Provided

Animals Provided with Health Care

Acceptable Animal Living Conditions

Following OIE Animal Health Code

Following Animal Care Assessment of NFAAC

Following CQA® and ACA™ Programs

**People & Community Specific:**

Labor Rights Policies Implemented

Workers Safety & Wellbeing % Compliant

**Manufacturing Specific:**

Land Conservation Measures Implemented

Soil Health Practices Implemented

Water Management Practices Implemented

Nutrient Management Practices

**Carbon Emissions Reduction - Facility**

2016 (total metric tonnes CO<sub>2</sub>eq): %

2017 (total metric tonnes CO<sub>2</sub>eq): %

**Energy Usage Reduction**

2016 (total MJ): %

2017 (total MJ): %

**Percent Renewable Energy Usage**

2016 (total MJ): %

2017 (total MJ): %

**Water Usage Reduction**

2016 (total gallons): %

2017 (total gallons): %

**Outgoing Waste to Landfill Percent Change**


2016 (total lbs): %

2017 (total lbs): %

**Waste Diversion from Landfill**

**GFSI Certification**

Baseline Year: January 20XX - December 20XX  
 Evaluation Period: January 20XX - December 20XX  
 Certification Number: XX-XXXX  
 Certification Period: XX/XX/20XX - XX/XX/20XX  
 For more information on the Certified Sustainability Facts of this product, please contact: info@GreenCircleCertified.com.  
 www.GreenCircleCertified.com  
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- CARBON NEUTRAL
- CARBON FOOTPRINT REDUCTION
- WATER USAGE REDUCTION - PER UNIT OF PRODUCT
- LAND CONSERVATION MEASURES IMPLEMENTED
- SOIL HEALTH PRACTICES IMPLEMENTED
- NUTRIENT MANAGEMENT PRACTICES
- CARBON EMISSIONS REDUCTION - FACILITY
- ENERGY USAGE REDUCTION
- PERCENT RENEWABLE ENERGY USAGE
- WATER USAGE REDUCTION
- OUTGOING WASTE TO LANDFILL PERCENT CHANGE
- WASTE DIVERSION FROM LANDFILL

# LOOKING FORWARD

Pioneering companies such as Interface are developing carbon neutral and carbon negative products by engineering carbon out of all the phases of their product life cycle. Other companies like ASSA ABLOY have developed a Sustainable Product Innovation process for their New Product Development program which focuses on making products more sustainable, reducing embodied carbon, and reducing operational carbon in the use phase.

## NEED HELP WITH LCA OR SPI?

**Contact Nicole Meyer**

Account Manager

Phone: 610-569-1047 x116

Email: [Nicole@SustainableSolutionsCorporation.com](mailto:Nicole@SustainableSolutionsCorporation.com)

[www.SustainableSolutionsCorporation.com](http://www.SustainableSolutionsCorporation.com)



## NEED HELP CERTIFYING EMBODIED CARBON REDUCTIONS?

**Contact Ryan Heins**

Account Manager

Phone: 610-569-1047 x119

Email: [Ryan@GreenCircleCertified.com](mailto:Ryan@GreenCircleCertified.com)

[www.GreenCircleCertified.com](http://www.GreenCircleCertified.com)



# WANT MORE INFORMATION ON EMBODIED CARBON?

Check out our Conquering Carbon webinar series! We sat down with sustainability experts from Interface, Skanska, Gensler, ASSA ABLOY, and the U.S. Green Building Council to talk all things embodied carbon. Click the links below to watch the recordings on YouTube!

- [Conquering Carbon: Evaluating Embodied Carbon in Products for a Sustainable Future](#)
- [Conquering Carbon: Using Optimization to Reduce Embodied Carbon and Design More Sustainable Products](#)

## RESOURCES



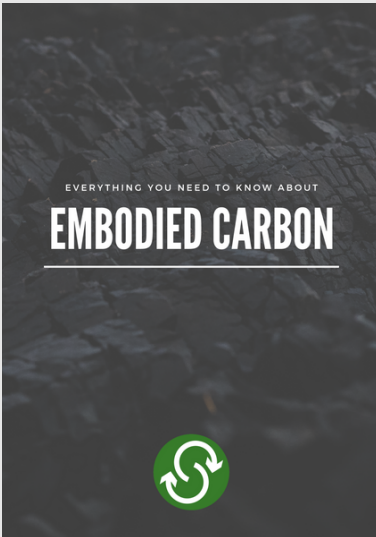
## CHECK OUT OUR PODCAST EPISODES!

Tad Talks Sustainability Podcast is hosted by sustainability expert, Tad Radzinski, and his daughter, Julianna Radzinski. During our episodes, Tad clearly explains everything you need to know about sustainability to help your company optimize your sustainability strategy and reach your goals. Tad offers tips for reducing embodied carbon and operational carbon, designing sustainable products and packaging, setting sustainability goals, and so much more.

Click here to listen:

- [Apple Podcasts](#)
- [Spotify](#)
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## OTHER DOWNLOADABLE DOCUMENTS



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### SUSTAINABLE SOLUTIONS CORPORATION

