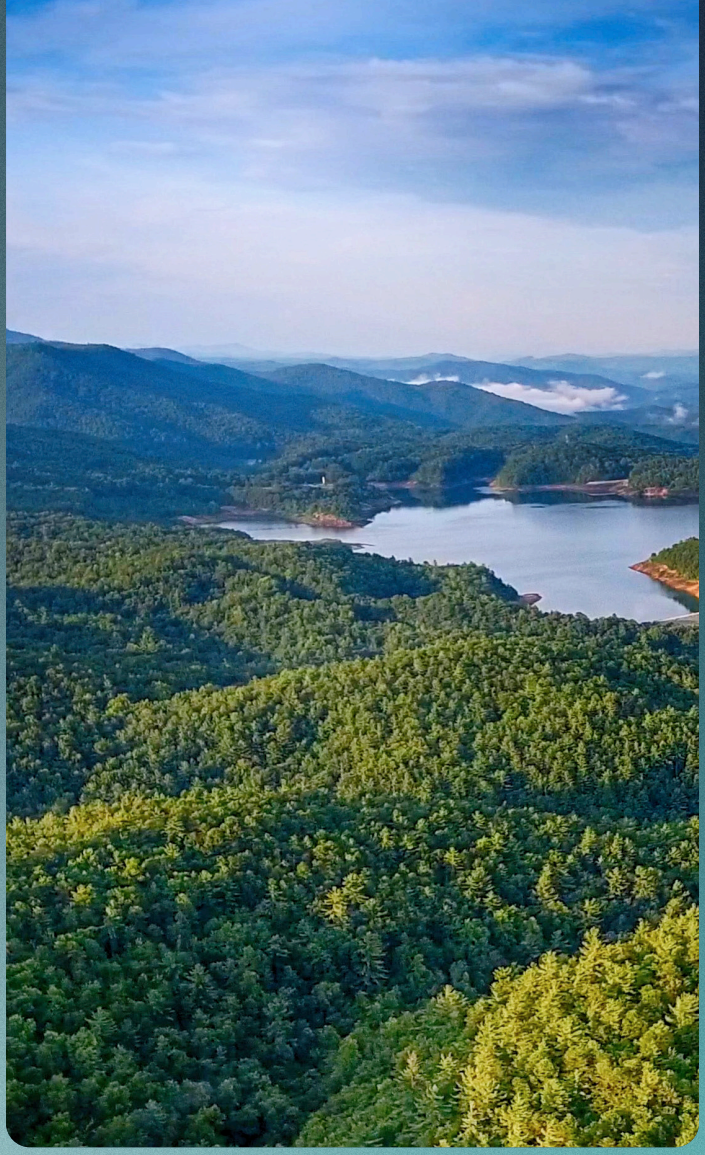

SC MEP

Sustainability Resource Guide

V1b | MAY 2025

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Welcome to the Sustainability Resource Guide

This guide is designed to equip South Carolina manufacturers with both the knowledge and the practical insights needed to navigate the evolving landscape of sustainability and related reporting responsibilities.

The guide is organized around the five pillars of sustainability and their associated elements:

1 **Design for Sustainability**

2 **Compliance for Sustainability**

3 **Energy Optimization**

4 **Waste Stream Reduction**

5 **Data and Supply Chain**

In addition to educational content, we have endeavored to provide information focusing on the business case or use case behind the elements of each pillar element. The SRG also contains a series of cases studies and a listing of public resources available to support and assist your organization along its sustainability journey.

The South Carolina Manufacturing Extension Partnership (SCMEP) is at the forefront of helping South Carolina's small and medium sized manufacturers to understand sustainability and guide them through their journey to adopt best practices, improve performance, ensure compliance, and to grow.

SCMEP is uniquely positioned in this regard as an organization that:

- Gets small and medium-sized manufacturers.
- Has the ability, working in conjunction with partners, to deliver a wide range of cost-effective sustainability solutions often supported by grants, awards, and other potential sources of funding.
- Facilitates introductions to trusted and qualified sustainability subject matter experts.

CREDITS / THANK YOU

Sincere thanks to the SCMEP Board of Directors and our partners, ALL4 and Sustain SC for their vision, passion, expertise, and drive to bring this resource guide to fruition. We could not and would not have gotten here without you!

I sincerely hope that you find this document informative, enlightening, and useful.

Andy Carr
President/CEO, SCMEP

Foreword by Sustain SC

At Sustain SC, we believe that sustainability is a fundamental driver of long-term success for South Carolina's industries, communities and natural resources. The Sustainable Resource Guide, developed by the South Carolina Manufacturing Extension Partnership (SCMEP) and ALL4 in partnership with Sustain SC, provides a critical roadmap for manufacturers looking to integrate sustainability into their operations while maintaining competitiveness and resilience.

By aligning industry expertise with sustainability principles, this guide equips South Carolina manufacturers with the tools, strategies, frameworks and best practices necessary to reduce their environmental footprint, optimize energy use and build more sustainable supply chains. The five-pillar approach outlined in this guide offers practical and actionable steps that can drive both economic growth and environmental stewardship.

As businesses navigate the evolving regulatory landscape and increasing market demand for sustainability, this guide will serve as a valuable resource for companies at every stage of their sustainability journey. We encourage manufacturers across our state to embrace these insights and lead the way toward a more resilient and prosperous South Carolina.

Leslie Skardon
CEO, Sustain SC

Five Pillars

SCMEP has developed this SRG based on a framework structured around five key sustainability pillars. These pillars provide a comprehensive roadmap for manufacturers aiming to enhance environmental performance, meet regulatory requirements, and improve operational efficiency.

1 Design for Sustainability

Emphasizes early environmental consideration in product development, incorporating sustainable design principles, life cycle assessments (LCA), and resource efficiency. Manufacturers are encouraged to leverage standards like the United States Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) certification, the United States Environmental Protection Agency's (U.S. EPA) ENERGY STAR program, and the International Well Building Institute's WELL Building Standard to reduce environmental impacts and enhance resource management.

RESOURCES

- United States Green Building Council's (USGBC)
- Leadership in Energy and Environmental Design (LEED)
- United States Environmental Protection Agency's (U.S. EPA)
- ENERGY STAR
- International Well Building Institute
- Well Building Standard

2 Compliance for Sustainability

Addresses the growing importance of compliance with sustainability-focused regulations. This section guides South Carolina manufacturers on meeting federal, state, and international regulatory requirements, developing company policies on energy, greenhouse gas (GHG) reduction, waste, and human rights, as well as responding to stakeholder demands for sustainable practices.

3 Energy Optimization

Focuses on strategies to improve energy efficiency and reduce costs, covering energy audits, LED (light-emitting diode) lighting, compressor optimization, and renewable energy options. By implementing these initiatives, manufacturers can significantly lower operational costs and carbon emissions.

4 Waste Stream Reduction

Provides actionable strategies for reducing waste and fostering circularity, including recycling, hazardous waste management, and extended product responsibility (EPR). This section promotes methodologies that help South Carolina manufacturers achieve zero waste goals and optimize resource recovery.

5 Data and Supply Chain

Centers on managing carbon footprints and supply chain sustainability through emissions reporting, baseline establishment, and supply chain transparency. Utilizing frameworks such as the GHG Protocol and CDP (Carbon Disclosure Project), this section highlights the importance of accurate data collection and digital management systems for sustainability tracking.

Together, these pillars equip manufacturers with the knowledge and tools needed to integrate sustainability practices, meet compliance standards, and enhance overall operational effectiveness while addressing environmental and social impacts.

Benefits of Sustainability

Integrating sustainability practices offers a range of strategic and operational benefits, setting manufacturers up for long-term success.

By incorporating these initiatives, companies can boost efficiency, reduce risks, and enhance market competitiveness, all while positively impacting the communities and environments where they operate. Adopting practices like energy efficiency, waste reduction, and resource optimization can lead to significant operational cost savings. Investing in renewable energy, energy-efficient technologies, and waste minimization strategies often results in lower utility bills, increased productivity, and reduced waste disposal expenses. Beyond operational efficiency, a strong commitment to sustainability can enhance brand reputation. Companies known for their environmental responsibility attract customers, talented employees, and like-minded business partners, giving them an edge in a market that increasingly values responsible brands.

Boost Efficiency

Reduce Risks

Enhance market competitiveness

Proactive sustainability efforts also reduce regulatory and compliance risks, keeping companies ahead of evolving regulations like the European Union's (EU) Corporate Sustainability Reporting Directive (CSRD) and California's Climate Corporate Data Accountability Act (SB 253). As Wall Street and private equity investors increasingly factor sustainability into investment decisions, manufacturers with robust sustainability initiatives have the potential to attract investment and may be able to access new markets that prioritize ethical business conduct.

Sustainability also drives innovation, spurring new approaches to product design, manufacturing processes, and supply chain management. Companies that develop sustainable products or adopt circular economy principles differentiate themselves and respond effectively to changing consumer preferences. Finally, these initiatives can contribute to long-term resilience by helping businesses address environmental risks and resource scarcity. By enhancing supply chain transparency and adopting renewable energy, companies can anticipate and mitigate potential disruptions, strengthening their position for the future.

How to Get Started

Sustainability is a complex field covering a broad range of topics and can mean a lot of things to different people.

When asked, people will often respond that being a sustainable company involves managing energy sources and use, GHG emissions, water use, waste generation and recycling. For others, it involves managing the impacts of the business on our employees, the communities where we operate, and society as a whole. Still others may indicate that a sustainable business manages risks and ensures positive economic returns for the future. All of these are parts of sustainability. This can make it hard to understand where to begin.

A good process for getting started is similar to the familiar process for continuous improvement that is utilized by the quality, environmental, and energy management systems under the ISO standards, namely the Plan-Do-Check-Act model. In this case, the process starts with developing a vision for what sustainability means to your company. This could take the form of a few bullet points to be discussed, or a more formal company sustainability statement. The important point is to begin with something on paper that can then be used to kickstart the conversation, be modified over time, used to consensus build, and ultimately be agreed to, as the process proceeds. This vision statement can then be used to develop leadership buy-in, a step that is critical for the process to be successful.

Assessing the company's impacts is a significant and vital step that will spur progress. This should include gathering data internally on topics such as energy sources and usage, calculating GHG emissions, measuring water usage and wastewater discharges, waste generation rates, recycling rates, landfill disposal rates, and other metrics that may be important to the business or stakeholders. This can feel overwhelming, so it is best to start with only one topic or a few topics, rather than trying to address everything at once. The impacts assessment can begin with rough estimates and be refined once it becomes clear which metrics are more important and more material to the business. This could include a variety of assessments like the SCMEP online sustainability assessment survey. SCMEP can also assist with other forms of assessment that may be helpful, including energy efficiency assessments, waste audits, or water use audits.

Once the impacts of the business have been evaluated, the next steps are to set goals and evaluate alternatives. These stages are frequently iterated to set a goal, determine the feasibility of reaching it, and what technologies or changes may be required, and adjusting the goals as may be necessary. Then the changes are implemented, and performance improvements are measured. In this step, it is important to focus on learning how the changes impact results, especially if the changes are based on changing employee behaviors. Finally, the results are communicated to management and stakeholders to gather feedback. The cycle then begins again by understanding the impacts of the business after the changes. This may include increasing the goals for the same topic area, or it may involve moving on to another topic. The process is summarized in Figure 1-1.

At any stage of evaluation, road mapping, or implementation, SCMEP has expert resources to support your company's needs and objectives.

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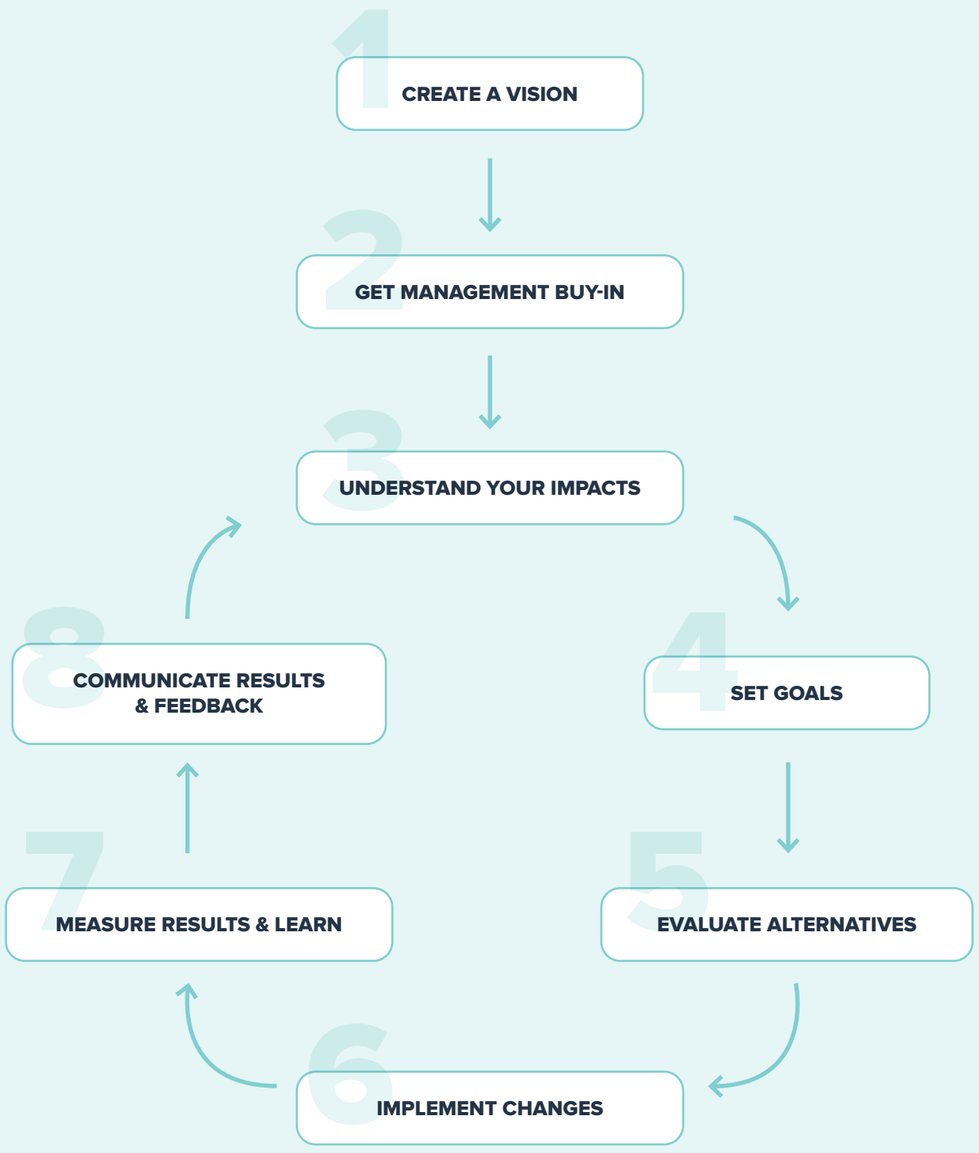
FIGURE 1-1

Sustainability Improvement Process



Sustainability Maturity Model

Sustainability is not a single objective. It is best to be viewed as a continuing process of learning, improving and maturing.

In this process, a company will shift from being in a disordered and high-risk state with limited data visibility, to being in a regenerative state, with a circular business model, sustainable supply chain, increased data visibility, and net positive operations. The steps along the full maturity model are shown in Figure 1-2.

FIGURE 1-2

Sustainability Maturity Model

Uncontrolled Risk → Increasing value creation → Sustainable resilience

Disordered	Aspirational	Reactive	Proactive	Transformative	Regenerative
High Risk Exposure	Developing Awareness	Risk aware but undefined	Risk based leadership	Vision based leadership	Circular business model
Material Risks Unknown	Early stakeholder and/or competitive pressure	Focus on avoiding negative consequences	Appetite for innovation	Optimized product lifecycle	Net positive operations
Data is poor or absent	Inclined to mobilize	Internal and external communications ineffective	Material risk quantified	Radical resource productivity	Sustainable supply chain
No strategy for long-term viability		Data is inconsistent or inadequate	Opportunistic cooperation across the value chain	Material risk mitigated	Insulated value creation
			Data asset growing in value	Carbon transition begun	

Basics For Sustainability

Harnessing Sustainability for Competitive Advantage

Environmental, Social, and Governance

Circularity

Biodiversity

Greenhouse Gas Emissions Management

Decarbonization

Risks and Opportunities Identification and Management

The Importance of Public Disclosure

Harnessing Sustainability for Competitive Advantage

Sustainability is increasingly important for manufacturers due to economic, regulatory, and market demands. Implementing sustainability programs well can lead to cost savings, operational efficiency, and decarbonization.

Programs such as those from the South Carolina Energy Office, Duke Energy, Dominion Energy, and the U.S. Department of Energy (DOE) Better Plants Program provide opportunities to reduce expenses through equipment upgrades and energy-efficient processes while also benefiting from tax incentives and rebates. This SRG outlines pathways manufacturers can follow to enhance their sustainability efforts and become more efficient.

In the global market, large corporations are increasingly prioritizing suppliers with strong sustainability strategies, positioning sectors like automotive and aerospace to thrive within sustainable supply chains. By adopting sustainability practices, manufacturers can stay ahead of stringent environmental regulations, such as those enforced by the U.S. federal government, states like California and New York, and international standards from countries like the United Kingdom (UK) and members of the EU. Proactive sustainability strategies support compliance, promote long-term operational efficiency, and enhance market competitiveness.

In addition to regulatory and market benefits, sustainability unlocks new markets and investment opportunities. Investors and consumers are showing a growing preference for companies with strong sustainability credentials, positioning manufacturers to attract sustainability-focused investments and meet the demand for products designed with sustainability in mind. This is especially relevant for industries like advanced materials, textiles, and chemicals, where innovations such as biodegradable products and energy-efficient machinery are driving long-term growth. Sustainability also strengthens risk management and resilience. Investments in renewable energy, water recycling, and other solutions help mitigate risks related to resource scarcity and the increased frequency of extreme weather events. These measures support operational continuity and help protect against supply chain disruptions. Additionally, sustainability plays a crucial role in attracting and retaining talent, as more workers are drawn to companies committed to environmental and social responsibility. This focus on sustainability helps manufacturers secure a skilled and values-aligned workforce for the future.

By prioritizing these practices, manufacturers in South Carolina can foster long-term growth and innovation. Incorporating circular economy principles and biodiversity into their operations makes them more adaptable and better positioned to seize emerging opportunities. Aligning with global sustainability standards drives innovation and environmental benefits and ensures long-term success in a rapidly changing marketplace.

PROGRAMS

South Carolina Energy Office

Duke Energy

U.S. Department of Energy Better Plants Program

Dominion Energy

Environmental, Social, and Governance

Environmental, Social, and Governance (ESG) refers to a set of sustainability reporting criteria used to evaluate a company's operations from environmental performance, social impact, ethical business practices, and operational governance perspectives.

ESG is a term widely used in the investment world, where investors incorporate these factors into their decision-making processes to assess long-term risks and opportunities. ESG reporting factors include:

ENVIRONMENTAL

This includes how a company manages its environmental impact, such as raw material sourcing, energy consumption, air pollutant and greenhouse gas emissions, water usage, waste, and utilization of renewable energy.

SOCIAL

This focuses on the company's relationships with its employees, suppliers, customers, and communities. This includes labor practices and community contributions and impacts.

GOVERNANCE

Involves the systems of leadership, management accountability, internal controls, stakeholder engagement, ethical guidelines, and risk management that guide the company's direction and sustainability efforts.

The rising focus on ESG reporting reflects growing concerns about environmental risks, social responsibility, and strong corporate governance. Many investors now consider ESG reporting factors when making investment decisions, as they can affect a company's reputation, regulatory compliance, and long-term financial performance.

Circularity

Circularity is another important sustainability concept that will be covered in the SRG.

In general, circularity refers to the design of supply-chain and production systems that minimize waste and continuously reuse materials, contributing to a "closed-loop" system. Instead of the traditional "take-make-waste" life cycle model, circularity focuses on keeping products, components, and materials in use for as long as possible, extracting maximum value before recovering and regenerating products at the end of their service life.

Circularity helps promote conservation of natural resources such as water, minerals, plants, and animals. This concept is important for manufacturers to understand as they develop their waste management strategies.[1]

[1] linkedin.com/pulse/circularity-key-unlocking-sustainable-future

Biodiversity

Biodiversity refers to the variety of life within ecosystems, encompassing species conservation, genetic diversity, and ecosystem services.

It plays a critical role in safeguarding essential resources and reducing risks within business supply chains. Manufacturers that prioritize biodiversity recognize the importance of protecting natural habitats and promoting sustainable practices, especially in sectors such as agriculture, forestry, and fisheries. Additionally, biodiversity is directly tied to key resources like raw materials, clean water, and healthy ecosystems across the state.

Industries such as manufacturing, agriculture, and forestry rely heavily on natural systems and biodiversity helps maintain the health of these ecosystems. This ensures the availability of essential resources while mitigating risks such as supply chain disruptions, resource scarcity, and environmental degradation. By adopting biodiversity-friendly practices, manufacturers can strengthen their resilience, comply with environmental regulations, and enhance their reputation. They may also benefit from cost savings through resource efficiency and sustainable sourcing. This proactive approach bolsters their position in global markets, where biodiversity practices are increasingly valued.

Greenhouse Gas Emissions Management

Effectively understanding, managing, and reporting Greenhouse Gas (GHG) emissions, especially carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) can be a significant component of a sustainability strategy for any company.

Gases like CO_2, CH_4, and N_2O accumulate in the atmosphere over long periods, trapping heat and amplifying their warming impact. This warming increases global temperatures, resulting in rising sea levels, more extreme weather events, increased health impacts and ecosystem disruptions.[2]

These environmental changes can have direct and indirect consequences on supply chains, resource availability, and operational stability. Disrupted weather patterns, intensified extreme weather events, such as severe storms and droughts, can negatively impact agriculture, forestry, and manufacturers across many sectors. Impacts may include increased risks to worker safety, impacted transportation corridors, and disrupt energy supplies. In addition to these weather impacts are the added threats of rising sea levels and increased ocean acidification, that pose serious threats to South Carolina's coastal regions and marshes, negatively affecting marine and tidal ecosystems along the coast, potentially harming industries like seafood and tourism, which rely on healthy marine environments and are a top income driving force for the state.

The resulting changes will exacerbate disruptions in key sectors such as agriculture, forestry, and manufacturing—industries critical to South Carolina's economy. Reducing GHG emissions across supply chains is important for manufacturers for several reasons including:

Regulatory compliance: Tightening regulations on emissions in states outside of South Carolina are pushing manufacturers to adopt GHG emissions management practices to avoid penalties and maintain operational viability. South Carolina manufacturers can ensure compliance and minimize the impacts of stricter regulations by taking proactive measures.

Cost savings and efficiency: Reducing emissions can lead to significant cost savings through improved energy efficiency and resource management, which can be important for manufacturers that operate on tight margins and depend on energy-intensive processes.

Reputation and competitiveness: Reducing emissions enhances brand reputation, particularly as major corporations and consumers are prioritizing sustainability in their supply chains and purchases. Manufacturers who demonstrate leadership in emissions reduction can gain a competitive edge in global markets where sustainability requirements are increasingly stringent.

Resilience and risk mitigation: Manufacturing operations, particularly those dependent on natural resources like agriculture, forestry, and water, can benefit from emissions reduction strategies that increase resilience to risks such as extreme weather events, resource shortages, and supply chain disruptions.

[2] science.nasa.gov/climate-change/causes

Decarbonization

The SRG focuses on various strategies that manufacturers can utilize to decarbonize their operations across their supply chains.

Decarbonization has become an important strategy for reducing GHG emissions and minimizing environmental impact. Decarbonization goes beyond compliance, and it represents a proactive approach to transforming industrial processes, operations, and supply chains to align with global reduction goals. Implementing decarbonization strategies will help to mitigate the risks and open new avenues for innovation, cost savings, and market leadership. By focusing on renewable energy, energy efficiency, electrification, supply chain optimization, and alternative fuels, manufacturers can significantly reduce their carbon footprint while gaining a competitive sustainability advantage. These strategies, which are highlighted in the subsequent sections of the SRG, serve as building blocks for a more sustainable future, enabling manufacturers to thrive in an economy driven by decarbonization.

Strategies and Technologies for Decarbonization

The SRG will dive into various strategies and technologies that manufacturers can explore to decarbonize their operations. A quick overview of the strategies include:

1 → **Renewable Energy:**
Shifting to renewable sources of energy like solar, wind, and hydropower, manufacturers can invest in large projects, enter power purchase agreements (PPAs), and/or install on-site systems to lower emissions and stabilize energy costs.

2 → **Energy Efficiency:**
Through the utilization of energy audits, upgrades, and best practices, manufacturers can obtain significant savings and reduced emissions, often with quick returns on investment.

3 → **Electrification:**
By transitioning to electric systems and moving away from fossil fuels for power, heating, cooling, and transportation, manufacturers can utilize renewable electricity and adopt technologies such as electric vehicles (EVs), significantly reducing emissions.

4 → **Supply Chain Optimization:**
Optimizing supply chains by sourcing locally, while enhancing transportation efficiencies and collaborating with sustainability-focused suppliers, can help minimize overall GHG emissions for manufacturers.

5 → **Alternative Fuels:**
Exploring low-carbon alternatives such as biofuels, hydrogen, and synthetic fuels and investing in these technologies can reduce reliance on fossil fuels and drive innovation.

Risks and Opportunities Identification and Management

A double materiality assessment evaluates how environmental and social issues can impact a company's financial performance and how the company's activities affect society and the environment, thus helping organizations understand risks and opportunities from both perspectives.

Double materiality plays a pivotal role in risk and opportunity identification and management, particularly by expanding the lens through which risk issues and opportunities are viewed. Double materiality addresses the financial implications of a company's actions and considers the broader social and environmental impacts, aligning with the "triple bottom line" of people, planet, and profit. This concept broadens traditional materiality, which is limited to financial concerns, to include how a company's activities impact stakeholders, society, and the environment. Effective risk and opportunity management will enable manufacturers to foresee potential threats and capitalize on emerging opportunities.

Double materiality, which has been embedded in the EU's CSRD and other sustainability reporting frameworks, provides a comprehensive model for identifying these risks and opportunities. Manufacturers can reference the CSRD reporting standard to guide strategic decision-making, ensure regulatory compliance, and enhance sustainability reporting. By integrating double materiality into their core strategy, manufacturers gain a dual focus: understanding both financial risks related to sustainability and acknowledging their role in mitigating environmental and social risks. This approach builds resilience and strengthens stakeholder trust, positioning manufacturers in South Carolina as leaders in sustainability. Managing risks while seizing opportunities through this lens will better equip manufacturers to handle evolving regulatory landscapes, shifting market demands, and the expectations of investors, consumers, and regulators. Conducting a double materiality assessment would fall into step three (Understanding your Impacts) of the Sustainability Improvement Process, Figure 1-1.

INTEGRATING DOUBLE MATERIALITY ALLOWS FOR:

- Understanding of financial risks related to sustainability
- Acknowledging your role in mitigating environmental and social risks

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Key Aspects of Double Materiality

The SRG will dive into various strategies and technologies that manufacturers can explore to decarbonize their operations. A quick overview of the strategies include:

FINANCIAL MATERIALITY (OUTSIDE-IN VIEW)

Financial materiality assesses how environmental and social issues pose risks or opportunities to a manufacturer's financial performance over the short, medium, and long term. These risks may include regulatory changes, reputational risks, and physical risks from climate change, such as extreme weather events, resource scarcity, or supply chain disruptions.

IMPACT MATERIALITY (INSIDE-OUT VIEW)

Impact materiality evaluates the company's effects on environmental and social systems, such as carbon emissions, resource depletion, and social equity. It involves examining both the positive and negative impacts of the company's operations, products, and value chain on stakeholders and the environment.

INTEGRATION INTO RISK MANAGEMENT FRAMEWORKS

To fully integrate double materiality, manufacturers must embed sustainability risks into their broader enterprise risk management (ERM) frameworks. This ensures that sustainability is not viewed as a standalone issue but as an integral part of managing overall business risks and opportunities.

Benefits of Embracing Double Materiality

Double materiality has emerged as an important framework for businesses, particularly in response to regulatory mandates such as the CSRD, which is why manufacturers should consider adopting the assessment practice. Beyond being a compliance requirement, it offers companies a strategic advantage by connecting financial risks with sustainability impacts. By fully integrating double materiality into risk management and strategic decision-making, businesses can better navigate the complexities of today's economic environment, build trust with key stakeholders, and position themselves as leaders in the global shift towards sustainability. Adopting double materiality early ensures that businesses are better prepared to meet the demands of a sustainability-focused market, thus ensuring long-term resilience and competitiveness.

Below are some of the key benefits of adopting double materiality that this SRG will explore further:

1 → **Holistic Risk Management:**
Double materiality enables companies to manage both financial and sustainability risks comprehensively. By addressing these intertwined risk factors, manufacturers are more resilient to evolving regulations and shifting stakeholder expectations. This holistic approach allows organizations to anticipate challenges and remain agile in responding to new market dynamics.

2 → **Enhanced Stakeholder Trust:**
Manufacturers that demonstrate a commitment to transparency and responsible business practices can foster stronger relationships with their stakeholders. Transparent reporting on sustainability and financial impacts builds credibility with investors and boosts customer loyalty and strengthens ties with local communities. This trust is an invaluable asset in today's business environment.

3 → **Compliance with Global Regulations:**
Adopting double materiality helps manufacturers stay ahead of stringent regulations such as the CSRD, ensuring regulatory compliance across multiple jurisdictions. By aligning with global sustainability standards, manufacturers can mitigate legal risks and avoid potential penalties while enhancing their reputation as forward-thinking industry leaders.

4 → **Fostering Innovation:**
Double materiality encourages innovation by pushing companies to explore products, services, and processes developed with sustainability in mind. By identifying sustainability challenges, manufacturers are driven to adopt innovative practices that reduce environmental impact while also creating new competitive advantages. This proactive approach to innovation is essential for long-term growth and differentiation in a sustainability-conscious market.

5 → **Strengthened Supply Chains:**
Assessing sustainability risks across the entire supply chain can lead to the development of more resilient partnerships with suppliers. By identifying and addressing sustainability challenges within the supply chain, manufacturers can work towards stronger collaborations with partners who share their sustainability goals. This alignment reduces risk and enhances operational efficiency and supply chain stability.

The Importance of Public Disclosure

Clear and transparent reporting on sustainability performance is essential for manufacturers aiming to build trust, demonstrate accountability, and show a commitment to environmental and social goals.

Effective sustainability disclosure goes beyond just sharing data; it's about providing an honest, accurate, and detailed view of a company's efforts, challenges, and progress on key sustainability measures. Typically, this involves sharing information on energy use, waste generation, water consumption, and GHG emissions across the company operations and supply chain. By openly sharing these insights, manufacturers can help investors and consumers make more informed choices. For investors, it provides a clearer understanding of the company's environmental and social risks and opportunities, while for consumers, it means the ability to support companies aligned with their values. This transparency cultivates a marketplace where financial and ethical considerations go hand-in-hand in decision-making.

Key Elements of Effective Disclosure

Gathering Data

Accurate and thorough data collection is the backbone of meaningful sustainability reporting. Gathering reliable data on sustainability metrics is crucial. Using digital tools and software platforms can make tracking, managing, and analyzing this data much easier, faster, and more reliable. These tools help automate calculations, reduce errors, and enable manufacturers to monitor their progress in real time. Leveraging digital tools also allows businesses to align sustainability data with their broader risk management strategies, supporting informed decision-making and improving operational efficiency.

Accuracy and Consistency

The data shared in sustainability reports must be reliable and consistent across different reporting cycles. This applies to environmental metrics, such as energy consumption, water use, and GHG emissions, as well as social metrics like diversity, labor practices, and community engagement. Manufacturers can ensure the credibility of their data by using third-party verification or audits to validate emissions, energy use, and resource management practices. Consistent and accurate data allows stakeholders to make comparisons over time and confidently assess the company's progress.

Alignment with Global Standards

Aligning public disclosure with recognized reporting frameworks such as the Global Reporting Initiative (GRI), International Sustainability Standards Board (ISSB), and the Task Force on Climate-related Financial Disclosures (TCFD), which have now been incorporated into the ISSB, ensures that disclosures are transparent, comparable, and globally recognized. This alignment also meets the expectations of investors, regulators, and stakeholders who rely on consistent reporting across industries. Adhering to these standards demonstrates that a manufacturer is committed to transparency and accountability, positioning itself as a leader in sustainability.

Materiality Focus

Effective sustainability reporting should focus on issues that are most material to a manufacturer's business operations and stakeholders. Companies must prioritize disclosing information on energy use, GHG emissions, supply chain sustainability, and labor practices. By concentrating on these material issues, companies can focus their management and investment efforts on these priority topics and provide deeper insights into both financial and non-financial risks and opportunities, which are increasingly important for investors and customers. Reporting on material topics demonstrates a company's awareness of the key sustainability issues impacting its industry and long-term success.

Long-term Goals and Targets

Public disclosures should also include long-term sustainability goals and targets, strategies to reduce energy use, and plans to achieve lowered or net-zero emissions. Disclosing plans to mitigate climate-related risks and sustainability strategies signals to stakeholders that the company is proactive in addressing future challenges. Providing insight into a company's goals and action plans helps investors assess its long-term viability and commitment to sustainability.

Benefits of Public Disclosure

Incorporating public disclosure into a manufacturer's sustainability strategy reinforces accountability and positions the business as a responsible leader in a global market. Public disclosure of sustainability data is more than a regulatory requirement; it is a strategic tool that builds trust with stakeholders, attracts responsible investment, improves market competitiveness, and empowers consumers to make informed choices. By leveraging technology like digital solutions to track and manage sustainability-related data, manufacturers can enhance reporting accuracy, streamline compliance, and provide stakeholders with reliable insights into their sustainability performance.

Pillar 1

Design For Sustainability

1.1

What is Sustainable Design?

Sustainable design focuses on reducing environmental, social, and economic impacts through efficient decisions in the design process.

Whether it's a product, building, or service, sustainability can be integrated by designing for energy efficiency, conserving resources, and planning for responsible waste disposal. A key aspect of sustainable design is understanding the product's entire life cycle to assess its impact on the triple bottom line - people, planet, and profit. This approach brings several advantages.

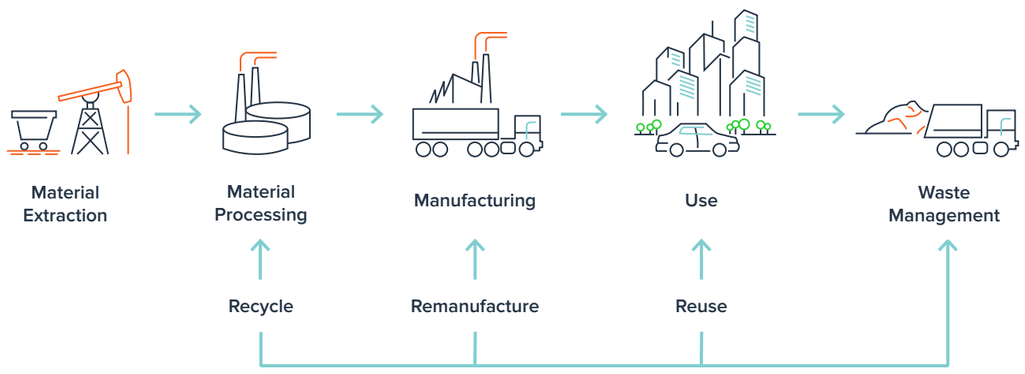
For the environment, sustainable design reduces negative impacts by conserving natural resources, lowering energy use and greenhouse gas emissions, and minimizing waste generation. It also enables health and well-being by improving air and water quality and reducing exposure to harmful substances. From an economic perspective, sustainable design can reduce costs by improving energy efficiency, reducing waste, and extending the product's lifespan. Socially, it fosters responsibility by considering the needs of both current and future generations, contributing to a more equitable and sustainable world. Additionally, sustainable design often aligns with regulatory requirements, as many regions now require transparency around environmental impact and adherence to sustainable practices.

Sustainable design is not a one-size-fits-all approach; it varies by industry, scale, and product. This section provides insights into understanding a product's footprint, which can serve as a foundation for setting improvement goals over time.

1.1.1 - Life Cycle Assessment

Life Cycle Assessment or LCA is an analytical methodology used to quantify the environmental impact of a product or process over the course of its entire life cycle. Figure 3-1 shows all the phases of the life cycle that are taken into consideration in the analysis.

FIGURE 3-1



An LCA can be used to determine the environmental footprint of your product across various impact categories. These impacts are expressed on the basis of a normalized standard unit, such as per unit mass (x/kg) of product. Examples of impact categories include:

Climate Impacts: Measures the impact of greenhouse gases on the climate, typically expressed in CO_2 equivalents (CO2e).

Ozone Depletion: Assesses the potential of substances to deplete the ozone layer, expressed in Trichlorofluoromethane (CFC-11) equivalents.

Eutrophication: Evaluates the potential over-enrichment of water bodies with nutrients, primarily phosphorus and nitrogen, leading to excessive growth of algae and depletion of oxygen concentrations, expressed in phosphate equivalents.

Acidification: Measures the potential of emissions to contribute to acid rain, which can harm ecosystems, expressed in sulfur dioxide equivalents.

Human Toxicity: Evaluates the potential harm of chemicals to human health, expressed in comparative toxic units.

Photochemical Ozone Formation: Assesses the potential for formation of ground-level ozone (smog), which is harmful to human health and vegetation, expressed in ethylene equivalents.

Ecotoxicity: Measures the potential harm of chemicals to ecosystems, expressed in comparative toxic units.

Resource Depletion: Assesses the consumption of natural resources, such as minerals and fossil fuels, expressed in terms of resource equivalents.

Water Use: Evaluates the impact of water consumption on the environment, expressed in cubic meters of water used.

Land Use: Measures the impact of land occupation and transformation on ecosystems, expressed in square meters of land used.

LCAs are complex calculations that follow the international ISO 14040 and 14044 standards. These calculations are typically performed in LCA software that uses what are called LCA methods to compute the environmental impact of a product, service, or process across its entire life cycle. There are three main scopes of a life cycle assessment which are listed below as well as in Figure 3-2. These scopes will vary depending on the purpose and product on which the LCA is conducted.

CRADLE-TO-GATE

This scope includes all the upstream processes in a product's life cycle. This scope begins with raw material extraction (cradle) and ends when the finished product leaves the manufacturing facility (gate).

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CRADLE-TO-GRAVE

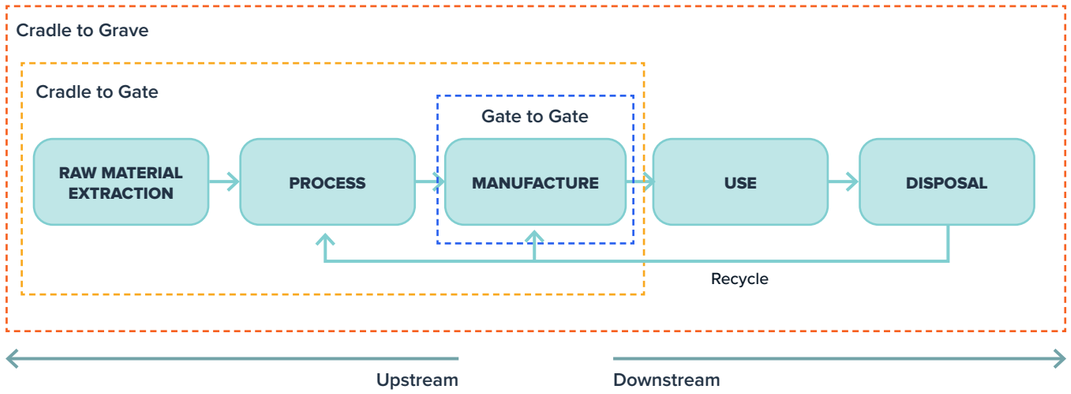
This is the most comprehensive scope and includes the entire life cycle of a product beginning with raw material extraction (cradle) and ending with final disposal of the product (grave).

GATE-TO-GATE

This scope focuses on the manufacturing step in the product's life cycle. This scope begins when raw materials enter the facility and concludes when the finished product leaves the facility.

FIGURE 3-2

Life Cycle Assessment Scopes



The use of LCAs varies significantly across industries, purposes, and regulatory landscapes. One key motivator for conducting LCAs is customer demand; larger companies, for instance, may seek to demonstrate that their product meets specific environmental standards or to gain a deeper understanding of their product's carbon footprint. To achieve this, companies often request LCAs from their suppliers. Policy and regulations are also strong drivers for LCA adoption. Governments and regulatory agencies use LCAs to shape environmental policies, providing a scientific foundation for regulations aimed at reducing ecological impacts. In the EU, regulations like the Carbon Border Adjustment Mechanism (CBAM) are emerging, which would impose taxes on imports based on a product's carbon footprint as determined by an LCA, incentivizing companies worldwide to adopt its practices to comply. Research and Development (R&D) is another area where LCAs play a crucial role. In both academic and industrial settings, LCAs are widely used to assess the environmental impacts of new technologies and materials, helping to reduce impacts and drive innovation.

1.1.2 - Environmental Product Declaration

Environmental Product Declarations (EPDs) are standardized documents that provide transparent, quantifiable information about the environmental impact of a product throughout its life cycle. EPDs were originally developed by, and are governed by, the International EPD System (IES).[3] These declarations follow international standards such as ISO 14025 for product labeling and declarations and typically include data on aspects like energy use, raw material consumption, air emissions (e.g., criteria pollutants, hazardous air pollutants, and GHG emissions), and waste generation. EPDs help manufacturers, suppliers, and consumers make informed decisions by assessing and communicating the environmental performance of products. EPDs are widely used in the construction and packaging industries to support green building certification, compare ecological footprints of materials, and align with sustainability goals in product development and supply chain management. The steps of developing an EPD include the following and can also be referenced in Figure 3-3.

1 → **Define the Product Category Rule (PCR):**
This outlines the guidelines and requirements of how to conduct the EPD analysis for a product within a specific industry and is defined by the IES.

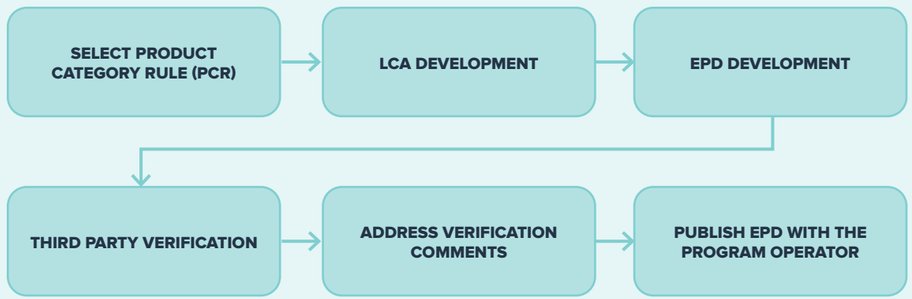
2 → **Develop the LCA:**
An LCA must be developed to provide all the information required for an EPD.

3 → **Compose EPD documentation:**
The results of the LCA will need to be compiled into the EPD document which is outlined in the IES General Program Instructions (GPI).

4 → **Verify EPD:**
EPDs need to be verified by an independent third party to be officially registered in the EPD database. The IES has a list of approved verifiers and accredited certification bodies available on its website.

FIGURE 3-3

EPD Information Flow



1.1.3 - Sustainability in R&D

It is important to plan for sustainable design early on in the development of a product. This allows for the development of innovative products that are also environmentally and socially responsible, and economically viable. During the R&D phase, it is important for manufacturers to consider how the product will impact the environment and people when it is brought up to full-scale production.

[3] www.environdec.com/home

1.2

Building Sustainably

Building facilities with sustainability in mind can help reduce environmental impact as well as costs.

Sustainable buildings are constructed in a way that leverages features and characteristics of the surrounding environment to help save energy and water and result in a lower embodied carbon footprint of the building.

1.2.1 - LEED® Certification

Leadership in Energy and Environmental Design (LEED) certification is a certification program for buildings that are designed to reduce environmental impact by optimizing energy use, conserving water, improving indoor air quality, and using sustainable materials. The LEED certification requirements are set forth by the U.S. Green Building Council (USGBC) which employs a tiered certification system including silver, gold, and platinum (the highest certification a building can obtain). LEED building certifications are applicable to the manufacturing industry in two ways: complying with sustainable material standards for LEED buildings and improving energy efficiency in manufacturing buildings.

One way to earn points toward different LEED certification levels is by using sustainable materials during construction, particularly those included in the 'Materials' category. The requirement that these materials have an EPD encourages manufacturers to produce EPDs for construction-related products. LEED-certified buildings, where sustainable design is integrated into both design and building processes, bring multiple advantages: including significantly lower utility costs due to improved energy and water efficiency.

Additionally, these buildings often lead to greater employee satisfaction and health benefits due to the emphasis on creating a healthy environment.

FIVE CATEGORIES IN WHICH TO GAIN POINTS:

- Location
- Innovation
- Materials
- Renewable Energy
- Indoor Environmental Quality

1.2.2 - ENERGY STAR®

ENERGY STAR is a Department of Energy (DOE)-backed program and certification that promotes energy efficiency across various products, buildings, and appliances. The ENERGY STAR program provides information on best practices, tools, and resources to increase energy efficiency of industrial processes and in buildings. This program aims to reduce energy needs and operational costs, and to reduce Scope 2 GHG emissions, lowering companies' overall environmental footprint. ENERGY STAR and LEED certifications are complementary programs. Using the ENERGY STAR program can help to achieve LEED Certification. Please see the energy optimization pillar section of the SRG for more information on this subject.

1.3

Digital Threads

To implement sustainable design, a company must understand the entire life cycle of its product.

A digital thread is a digital representation of a product's lifecycle, from design and development through manufacturing, maintenance, and disposal. It provides accurate, up-to-date product information across all its various stages and systems and makes the information accessible to all stakeholders. Additionally, the digital thread provides valuable data for conducting an LCA. By enhancing collaboration, streamlining workflows, and supporting real-time decision-making, digital threads play an important role in digital transformation. They allow companies to harness product data more effectively, drive innovation, improve transparency, and optimize processes. For example, tracking a product's journey through the supply chain can reveal environmental impacts at each stage, guiding the creation of an LCA that identifies areas with high environmental burdens. With comprehensive, high-quality data on hand, companies can address process inefficiencies, ultimately advancing their sustainability goals.

1.4

Design Tools

There are a wide variety of tools that designers and engineers can use as they consider sustainability in the product development process. These tools generally fall into one of 13 different areas of focus, as follows:

1 Life Cycle Assessment (LCA) Tools

As mentioned previously, LCA software helps to evaluate the environmental impact of a product throughout its entire lifecycle, from raw material extraction to end-of-life. LCA software will identify issues of concern related to the materials, manufacturing, distribution, use, and disposal phases. Some examples of commonly used LCA software include Sphera (formerly GaBi), OpenLCA, and SimaPro.

2 Eco-Design Tools

These tools help designers to integrate environmental considerations into product design. Examples include:

- SolidWorks Sustainability – Provides environmental impact analysis integrated into 3D modeling design.
- Granta MI Eco Audit – Assesses product material choices relative to environmental impact.
- Ansys CES Selector – Optimizes materials, reduces waste, and improves recyclability.

3 Material Selection Tools

Enable designers to choose suitable materials with lower environmental footprints. Examples include:

- MatWeb – A comprehensive material property database that also includes sustainability metrics.
- Ashby's Material Charts – Provides a way to visualize material performance vs. economic impact.

4 Energy Efficiency Analysis Tools

Provide a way for designers to assess and minimize energy consumption in product usage and manufacturing. Examples include:

- DOE EnergyPlus – Used for modeling energy usage of buildings and systems.
- eQUEST – A simplified tool for quick energy modeling and sustainability analysis.

5 Carbon Footprint Calculators

Help designers quantify and minimize greenhouse gas emissions associated with a product's manufacture and use. Examples include:

- EPA Simplified GHG Emissions Calculator
- CarbonScope
- GHG Protocol Tools

6 Circular Economy and Cradle-to-Cradle (C2C) Tools

These tools simplify the designer's task of designing products for reuse, remanufacturing, and recycling. Examples include:

- Cradle to Cradle Certified® Product Standard – Certification guidelines for products designed with circular principles.
- CircularIQ – Assists with evaluating a product's circularity and resource efficiency.

7 Additive Manufacturing Tools

Help the designer to optimize 3D printed components to reduce material usage and waste. Examples include:

- CAD Topology Optimization – Ansys, Fusion 360, SolidWorks, and other modeling software offer optimization tools for 3d printed parts.
- nTopology – Advanced topology tools going beyond what standard modeling programs typically offer.

8 Water and Resource Use Analysis Tools

Provide the ability to assess and minimize water usage related to product production and use. Examples include:

- WRI Aqueduct
- Water Footprint Network Tools

9 End-of-Life Design Software

Incorporates design strategies for disassembly, recycling, and reuse. Examples include:

- Design for Disassembly Guidelines – Typically included in manufacturing standards such as ISO 14006.
- Sustainable Minds – Focuses on product transparency and end-of-life considerations. In this context transparency means openly disclosing information about a company's environmental, social, and governance impacts.

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1 Environmental Standards and Certification Tools

These tools help ensure designs meet sustainability standards. Examples include:

- ISO 14001 – Environmental management systems
- ISO 14040/14044 – Lifecycle assessment
- LEED – Certification for buildings with sustainable designs

14 Simulation Tools for Sustainable Design

Help designers to simulate product performance under sustainable constraints. Examples include:

- Ansys Fluent – Energy and resource optimization in fluid dynamics
- COMSOL Multiphysics – Simulates environmental conditions and sustainability factors.

15 Supply Chain and Logistics Optimization Tools

Assist with minimizing environmental impacts from sourcing and distribution. Examples include:

- Aspen Supply Chain Planner – Optimizes logistics and sourcing.
- SAP EHS Management – Tracks and manages sustainability in supply chains

16 Design for Manufacturability Tools

Helping designers to optimize and minimize materials, processing, and energy use. Design for Manufacturability is a standalone design methodology that can be adapted for use with Design for Sustainability. Examples include:

- SolidWorks DFMXpress – A separate SolidWorks add-on that evaluates manufacturability based on tolerances, materials, and processes.
- Autodesk Fusion 360 – Tools for simulation, machining, and manufacturability analysis.
- PTC Creo – Advanced DFM functionality for complex designs.

Pillar 2

Compliance For Sustainability

2.1

Current Sustainability Compliance Landscape

Sustainability has evolved into a significant business requirement, driven by global awareness of environmental impacts and increasing regulatory expectations.

For manufacturers, compliance goes beyond mere adherence to environmental laws; it involves meeting emerging standards aimed at mitigating climate impacts, reducing GHG emissions, and enhancing transparency.

2.2

Stakeholder Drivers

Addressing climate impacts has become increasingly important as new legislation, developing in jurisdictions outside of South Carolina, is driving greater transparency and accountability for South Carolina companies.

With a deeper understanding of climate-related issues, businesses are experiencing growing pressure from stakeholders, customers, investors, and policymakers, to enhance their environmental performance.

Historically, companies have focused on maximizing profits and shareholder value. However, as environmental issues have become more prominent, the role of companies has broadened to consider impacts on a wider array of stakeholders, including communities and the environment. For example, the Business Roundtable—a coalition of over 200 leading U.S. CEOs—introduced a stakeholder model urging businesses to serve all stakeholders: customers, employees, communities, suppliers and the environment.[4] This shift reflects heightened expectations for corporations to act as responsible global citizens. As a result, many companies are embedding sustainability into their long-term strategies, establishing incentives, metrics, and governance frameworks to guide their environmental initiatives.

This shift in scope brings significant implications. Both consumers and corporate buyers increasingly consider sustainability in their purchasing choices. Consumers often “vote with their wallet,” while evolving federal and international standards require companies to gather sustainability data from their supply chains. Paired with internal goals, this trend is reshaping corporate purchasing and pushing suppliers to meet environmental benchmarks. By understanding these dynamics, manufacturers can better align with stakeholder expectations, enhance competitiveness, and contribute globally to sustainability.

[4] businessroundtable.org/for-long-term-success-companies-must-deliver-for-all-stakeholders

2.3

Key Drivers

Governments are introducing stricter regulations like the EU's CSRD and the California Climate-Related Financial Risk Act, which require manufacturers to disclose climate-related risks and outline their strategies to address them.

At the same time, consumers, investors, and other stakeholders are demanding greater transparency and accountability around climate impacts. This growing expectation pushes manufactures to integrate sustainability into their core strategies, influencing decisions across procurement, operations, and reporting practices. Additionally, an increased focus on corporate responsibility is prompting businesses to consider their impact on a wider range of stakeholders, not just shareholders, underscoring a shift toward broader accountability in addressing environmental and social issues.

2.4

Implications for South Carolina Manufacturers

With sustainability increasingly influencing purchasing decisions, South Carolina manufacturers that align with these goals can strengthen their market competitiveness.

Large corporations setting sustainability benchmarks are now expecting their suppliers to meet similar standards, putting pressure on the manufacturing industry to comply in order to attract and retain valuable business partners. Proactively adhering to new sustainability regulations and requirements ensures legal compliance and reinforces a commitment to global environmental goals. By adopting frameworks like EPDs for waste management and tracking environmental impacts, companies can further enhance their transparency and appeal to both customers and corporate clients focused on sustainability.

2.5

Reporting Frameworks, Standards, Rankings, and Ratings

Effective sustainability reporting is essential for organizations aiming to enhance transparency, build stakeholder trust, and demonstrate their commitment to sustainability principles.

By adopting established frameworks and standards, companies ensure consistency, accountability, and alignment with global sustainability efforts.

2.5.1 - Reporting Frameworks

Manufacturers who prioritize sustainability reporting frameworks can significantly enhance their business operations and market position. These frameworks help ensure compliance with emerging local, state, and federal regulations, minimizing the risk of penalties in an increasingly regulated environment. Additionally, as investors and customers demand greater transparency regarding sustainability practices, adherence to established reporting frameworks can bolster company reputation and build trust with key stakeholders. This transparency can also facilitate access to capital, as financial institutions increasingly favor companies with strong sustainability practices, using these metrics to evaluate investment opportunities.

Furthermore, sustainability reporting frameworks provide standardized metrics that allow for benchmarking of performance against industry peers, revealing strengths, weaknesses, and opportunities for continuous improvement. In a competitive marketplace, showcasing sustainability initiatives can attract environmentally conscious customers and partners, enhancing market competitiveness. These frameworks encourage a structured approach to sustainability, aiding in the identification of long-term goals and strategies that lead to improved operational efficiencies, cost savings, and reduced environmental impact. Finally, aligning with globally recognized standards, such as GRI and UNSDGs, enhances credibility and demonstrates a commitment to broader global sustainability efforts.

ADHERING TO REPORTING FRAMEWORKS CAN:

- Enhance business operations and market position
- Bolster company reputation
- Build trust with key stakeholders
- Facilitate access to capital
- Attract concious customers & partners
- Improve cost savings
- Enhance credibility
- Demonstrate a commitment to sustainability efforts

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The following are the main frameworks related to ESG reporting:

CDP (formerly Carbon Disclosure Project)	A widely recognized platform for companies to disclose their environmental impacts, including greenhouse gas emissions, water usage, and deforestation risks. Participating in CDP's annual questionnaire allows companies to benchmark their performance against peers and identify opportunities for improvement. CDP also assigns scores to organizations that disclose in three categories: Climate, Water, and Forestry. These scores can be shared publicly and leveraged as proof-points of transparency and credibility for companies that receive them.
SBTi (Science-Based Targets initiative)	Provides a framework for organizations to set ambitious emission reduction targets aligned with climate science, demonstrating leadership in climate action and enhancing credibility and accountability in sustainability efforts.
UNSDGs (United Nations Sustainable Development Goals)	A universal framework for addressing global challenges, including poverty, inequality, climate change, and environmental degradation. Aligning ESG goals with the UNSDGs allows companies to contribute to a sustainable future while enhancing their reputation among stakeholders.
GHG Protocol (Greenhouse Gas Protocol)	Offers comprehensive guidance for measuring and managing greenhouse gas emissions by categorizing emissions into Scope 1, 2, and 3, helping organizations understand their carbon footprint and identify key areas for reduction.
ISO (International Organization for Standardization)	ISO standards, such as ISO 14001 for environmental management systems, and ISO 50001 for energy management systems provide a systematic approach to managing environmental and energy responsibilities, respectively, improving operational efficiency, reducing waste, and enhancing overall sustainability performance.

2.5.2 - Reporting Standards

Manufacturers should prioritize sustainability reporting standards due to their significant impact on operational effectiveness and market positioning. These standards, like the corresponding frameworks, ensure compliance with local, state, and federal laws, minimizing the risk of penalties in an increasingly regulated environment. Additionally, as stakeholders demand greater transparency in sustainability practices, these standards provide a structured framework for disclosing relevant information, fostering trust with investors, customers, and regulatory bodies.

Moreover, these standards enable benchmarking against industry peers, helping organizations identify strengths, weaknesses, and opportunities for continuous improvement in their sustainability initiatives. Actively engaging in sustainability reporting can set manufacturers in South Carolina apart, attracting customers who care about sustainability and enhancing their market presence. By systematically assessing their sustainability practices, they can achieve improved operational efficiencies and cost savings, positively impacting their bottom line. Many sustainability reporting standards also align with global initiatives, such as the UNSDGs, allowing South Carolina manufacturers to contribute to broader societal goals while demonstrating their commitment to global sustainability efforts. Key reporting standards include:

U.S. EPA'S GREENHOUSE GAS MANDATORY REPORTING RULE (GHG MRR)

The GHG MRR requires certain facilities in the U.S. to report their greenhouse gas emissions annually to U.S. EPA, ensuring accountability and alignment with national environmental protection policies. This rule is discussed in greater detail in Section 2.7.2.

EU'S CORPORATE SUSTAINABILITY REPORTING DIRECTIVE (CSRD)

The CSRD regulation requires companies operating in the EU to report detailed information on their environmental and social impact, aiming for enhanced transparency in sustainability efforts. This rule is discussed in greater detail in Section 2.9.5

GLOBAL REPORTING INITIATIVE (GRI)

The GRI is a widely recognized framework for sustainability reporting, covering economic, environmental, and social impacts. It ensures comprehensive disclosure and helps companies communicate their sustainability progress to various stakeholders.

SUSTAINABILITY ACCOUNTING STANDARDS BOARD (SASB)

SASB provides industry-specific ESG standards, focusing on financially material sustainability issues. This allows companies to report on the sustainability factors most likely to affect their financial performance.

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2.5.3 - Reporting Rankings/Ratings/Scoring

Achieving high scores in prominent ESG rating systems enhances transparency and credibility, while also providing valuable insights into a company's sustainability performance. Manufacturers should consider working toward recognition in the following sustainability rankings:

- Sustainalytics provides risk assessments related to sustainability issues, helping investors understand a company's exposure to and management of sustainability risks.
- The MSCI (Morgan Stanley Capital International) offers sustainability ratings that evaluate a company's exposure to industry-specific risks and how effectively they manage those risks compared to peers.
- EcoVadis assesses sustainability across supply chains, focusing on environmental impact, labor practices, and ethical business practices. A high score enhances a company's reputation and demonstrates its commitment to responsible and sustainable operations.
- GRESB (Global Real Estate Sustainability Benchmark) assesses sustainability performance in real estate portfolios and infrastructure, providing a measure of sustainability in real estate assets.ity efforts.

By adopting recognized reporting frameworks, standards, and striving for high scores in sustainability rankings, organizations can enhance their sustainability reporting practices. This commitment to transparency and accountability improves stakeholder trust and drives continuous improvement in sustainability performance, contributing to a more sustainable future. Figure 4-1 shows an overview of the Sustainability Reporting landscape today around the various frameworks, standards, rankings, and ratings:

FIGURE 4-1

Sustainability Reporting Landscape

A set of principles and guidelines for how information is structured.

Detailed requirements of what should be reported on each topic.

Assessing ESG performance

2.6

Company Policy Creation

Developing robust company policies is another key to integrating sustainability into day-to-day operations.

After completing a double materiality assessment and aligning with relevant sustainability frameworks, manufacturers can outline clear policies that reflect their sustainability strategy and goals. These policies provide a framework for operational decisions and establish accountability, ensuring that sustainability is embedded into the fabric of business operations. Key areas for policy creation include energy, GHG emissions and decarbonization, waste management, procurement, and human rights—each playing a crucial role in shaping sustainable manufacturing practices.

Energy: Manufacturers can focus on increasing energy efficiency in production processes by upgrading to energy-saving technologies, optimizing equipment use, and investing in renewable energy sources. Many South Carolina manufacturers are already adopting solar energy or working with local utilities to purchase renewable power.

GHG Emissions/Decarbonization: Manufacturers should aim to reduce their carbon footprint by transitioning to renewable energy sources like solar or wind, implementing energy efficiency programs, and setting science-based emissions reduction targets. These efforts align with state and federal GHG reporting requirements.

Waste: Manufacturing facilities can work toward zero-waste goals by minimizing material waste, recycling byproducts, and implementing sustainable packaging solutions. Policies can outline strategies to reduce waste at every stage of production and set clear reduction targets.

Procurement/Supply Chain: Manufacturers can develop policies ensuring that their suppliers meet strict environmental and ethical standards. This includes evaluating supplier practices for energy use, waste management, and human rights issues, particularly for materials sourced internationally. Selecting suppliers that align with sustainability goals enhances transparency and reduces supply chain risks.

Human Rights: Policies can establish guidelines that ensure fair labor practices throughout the supply chain, protecting workers' rights and ensuring compliance with international labor standards. This might also include sourcing conflict-free materials and avoiding suppliers with known human rights violations.

By developing strong, actionable policies in these areas, manufacturers can stay competitive, meet regulatory requirements, and contribute to a more sustainable future. These policies will guide decision-making and operations, helping manufacturers reduce their environmental impact while fostering innovation and growth.

2.7

United States Sustainability Compliance Landscape

The regulatory landscape around sustainability is evolving rapidly with the change in presidential administrations, impacting both federal contractors and private businesses, including manufacturers in South Carolina.

Understanding these regulations is critical for businesses looking to stay compliant and competitive. The following highlight key developments that are occurring in the United States:

2.7.1 - EPA Deregulatory Actions

On March 11, 2025, the U.S. EPA Administrator announced a list of 31 deregulatory actions, several of which will have significant impact on the regulatory landscape as it applies to sustainability. These actions include reconsideration of regulations that are either directly focused on GHG reductions or would result in significant GHG reductions in addition to reducing other pollutants. Reconsideration is likely to result in elimination or easing of the regulatory requirements in these regulations. The actions include:

- Reconsideration of regulations on power plants (known as the Clean Power Plan 2.0).
- Reconsideration of Mandatory Greenhouse Gas Reporting Program.
- Reconsideration of the emissions limitation guidelines (ELG) and standards for the Steam Electric Power Generating Industry.
- Revising the Social Cost of Carbon which is used in the economic impact analysis for regulatory actions.
- Reconsideration of light-duty, medium-duty, and heavy-duty vehicle GHG regulations.
- Reconsideration of the 2009 Endangerment Finding that established GHGs as pollutants under the Clean Air Act.

2.7.2 - The Greenhouse Gas Reporting Program

The Greenhouse Gas Reporting Program (GHGRP) is a U.S. EPA initiative that mandates large GHG emitters and suppliers of certain fossil fuels and industrial gases to report their emissions annually. Established under the Clean Air Act, the GHGRP includes the Mandatory Greenhouse Gas Reporting regulation (40 CFR Part 98), which aims to collect comprehensive emissions data to inform policy and regulatory decisions, track GHG trends, and support climate change mitigation efforts. Facilities emitting 25,000 metric tons or more of CO2e per year are required to report their emissions, covering over 40 industries, including power plants, refineries, chemical manufacturing, and transportation fuel suppliers. The program collects detailed emissions data on various GHG, including CO_2, CH_4, and N_2O. Manufacturers must comply with the reporting requirements, facing potential penalties for non-compliance, while U.S. EPA monitors submissions and conducts audits to ensure data accuracy. The reported data is publicly available, providing transparency and enabling stakeholders—such as policymakers, researchers, and the general public—to monitor emissions and track progress effectively. By providing accurate and reliable GHG data, the GHGRP serves as a foundation for regulatory actions and market-based climate initiatives.

2.8

State Level Regulations

Several U.S. states are also implementing policies requiring more comprehensive sustainability considerations. These include:

California	The California Environmental Quality Act (CEQA) requires environmental review for public and private projects, assessing impacts such as GHG emissions and potential contributions to climate change.
Georgia	Under the Georgia Environmental Policy Act (GEPA), public projects must undergo environmental review before development, ensuring environmental impacts are considered.
Minnesota	The Minnesota Environmental Policy Act (MEPA) mandates reviews for state and private projects, especially those with state funding, to evaluate their climate impacts.
New York	The New York State Environmental Quality Review Act (SEQRA) applies to public and private projects, requiring evaluations of their environmental and climate-related impacts.
Washington	The State Environmental Policy Act (SEPA) mandates environmental reviews for public projects, focusing on the potential environmental and climate-related impacts.

California and New York lead in addressing GHG emissions at the state level, as they require reviews of state projects specifically for their potential to contribute to climate change. As severe weather events and climate-related impacts continue to grow, we expect these regulations to expand, further emphasizing the importance of sustainability efforts for U.S. manufacturers. These trends highlight the increasing need for businesses to adopt sustainable practices and align with both federal and state-level expectations, ensuring compliance while enhancing their market position.[6]

[6] ballotpedia.org/State_environmental_policy_acts

2.9

International Sustainability Compliance Landscape

Climate-related regulation and policy are becoming a global issue, and many key international frameworks are already in place.

These regulations and agreements shape corporate sustainability strategies and disclosure requirements around the world. The following subsections are key international frameworks that manufacturers may find beneficial.

2.9.1 - Paris Agreement

Signed by 196 countries in 2015, the Paris Agreement aims to limit global warming to well below 2°C, with efforts to keep it within 1.5°C above pre-industrial levels. Each country sets nationally determined contributions (NDCs) to reduce GHG emissions, creating a framework for accountability. The agreement encourages transparency and regular progress reporting, influencing businesses to align their strategies with climate goals through emissions reduction and sustainability practices. Although the Trump administration initiated the year-long process of withdrawing from the agreement upon his inauguration, countries including the EU member states have integrated Paris Agreement goals into local laws, such as the European Climate Law, which mandates achieving climate neutrality by 2050. Additionally, under the EU's CSRD, companies must align their reporting with the European Sustainability Reporting Standards (ESRS), further integrating the Paris Agreement's objectives into corporate accountability.

2.9.2 - United Nations Sustainable Development Goals (UNSDGs)

INCORPORATING SDGs ALLOWS FOR:

- Alignment with international priorities
- Contributions to broader societal goals
- Ability to address investor expectations for responsible business practices

Adopted in 2015 as part of the 2030 Agenda for Sustainable Development, the UNSDGs consist of 17 goals designed to end poverty, protect the planet, and promote prosperity. Businesses that use the SDGs to shape their sustainability strategies set targets aligned with specific goals like SDG 13: Climate Action, which focuses on mitigating climate change and enhancing resilience. The SDGs provide a global framework that many multinational corporations, such as Unilever and Nestlé, have integrated into their sustainability strategies. Incorporating the SDGs allows businesses to align with international priorities and contribute to broader societal goals while also addressing investor expectations for responsible business practices.

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2.9.3 - Task Force on Climate-related Financial Disclosures (TCFD)

Established by the Financial Stability Board in 2015, the TCFD developed a framework for companies to disclose climate-related risks and opportunities in their financial reports. The TCFD encourages scenario analysis, examining how climate change might affect business under various climate futures, and it distinguishes between transition risks—such as regulatory changes—and physical risks, like extreme weather events. The TCFD framework is widely adopted across markets and sectors, including the EU's CSRD and the UK's Climate-related Financial Disclosure Regulations, making it central to global corporate climate risk reporting. Japan and New Zealand have also incorporated TCFD-aligned disclosures into their financial reporting frameworks.

2.9.4 - International Sustainability Standards Board (ISSB)

The ISSB, established by the International Financial Reporting Standards (IFRS) Foundation in 2021, is working to create a global baseline for sustainability reporting standards. The ISSB's standards are designed to help investors assess climate-related risks and opportunities and inform decision-making. The ISSB builds on the TCFD recommendations, focusing on material risks across the short, medium, and long term, aiming to harmonize global sustainability disclosures. The ISSB is being adopted internationally, with jurisdictions like the EU and UK looking to incorporate its standards alongside their regulatory requirements. This global alignment helps multinational corporations streamline reporting processes and improve transparency on sustainability issues.

2.9.5 - European Union's Corporate Sustainability Reporting Directive (CSRD)

The CSRD significantly enhances the scope of sustainability reporting across the EU. It applies to large companies and listed SMEs, requiring disclosures on ESG factors. The directive requires businesses to follow the ESRS, which are closely aligned with the Paris Agreement and TCFD recommendations. The CSRD demands detailed reporting on climate-related risks, emissions, and impacts across value chains, including Scope 1, Scope 2, and Scope 3 emissions.

2.9.6 - The European Green Deal

The European Green Deal is an ambitious EU initiative aimed at making Europe the first climate-neutral continent by 2050. It provides a roadmap for transforming the economy and society to address climate change, ensure sustainability, and boost economic growth through green technologies and job creation. A key element is the Sustainable Finance Taxonomy, which classifies environmentally sustainable activities and requires companies to disclose how their operations align with climate mitigation and adaptation goals, promoting transparency around climate risks and opportunities.

The Green Deal's primary objectives include achieving climate neutrality by 2050, cutting GHG emissions by at least 55% by 2030, and fostering sustainable growth decoupled from resource consumption. Its key components cover climate action, renewable energy expansion, energy efficiency, circular economy, sustainable agriculture, biodiversity protection, zero pollution, and industrial innovation. It also mobilizes significant funding for green investments, aligns trade policies with climate goals, and ensures a just transition for industries and workers, positioning the EU as a global climate leader.

As part of this broader strategy, the CBAM is designed to prevent "carbon leakage"—the shift of production to countries with weaker climate regulations—and support the EU's climate goals. CBAM imposes a carbon price on imports from carbon-intensive industries such as cement, steel, aluminum, and electricity, aligning foreign producers with EU standards. It encourages global industries to adopt greener practices, leveling the playing field for EU producers under strict carbon regulations. After a reporting phase from 2023 to 2025, full financial obligations for CBAM will begin in 2026, influencing international trade and promoting greener industrial practices worldwide.

2.9.7 - UK Climate-Related Financial Disclosure Regulations

In line with the TCFD guidelines, the UK has implemented mandatory climate-related financial disclosures for publicly listed companies, large private companies, and limited liability partnerships (LLPs). This regulation, titled "Mandatory climate-related financial disclosures by publicly quoted companies, large private companies, and LLPs" requires these entities to provide clear and consistent reporting on how climate risks and opportunities could impact their financial performance. The goal of this legislation is to enhance transparency and help investors, lenders, and other stakeholders understand the financial implications of climate-related risks and opportunities. By incorporating climate risks into their financial disclosures, businesses must evaluate and communicate the potential financial impacts of physical risks (such as extreme weather events and resource shortages) and transition risks (such as regulatory changes, market shifts, and technology advancements).

This regulation supports the UK's broader goal of achieving net-zero carbon emissions by 2050, as it encourages companies to align their strategies with climate resilience and sustainability. It also provides a framework for more informed decision-making in the financial sector, allowing capital to be allocated towards greener and more sustainable initiatives. The disclosures help drive the UK's climate agenda by promoting better risk management, improving market stability, and ensuring that companies are prepared to transition to a low-carbon economy. Moreover, the UK's approach sets a benchmark for other countries and regions seeking to incorporate climate risk into financial systems, furthering global efforts to integrate sustainability into corporate governance and financial planning.

2.9.8 - Japan's Corporate Governance Code

Japan's Corporate Governance Code encourages companies to integrate ESG factors into their governance structures, with a focus on long-term sustainability. While not mandatory, the code has significantly influenced the Japanese corporate sector, pushing for more transparent climate risk disclosures.

International sustainability-related regulations, from the Paris Agreement to the TCFD and ISSB standards, are shaping the way businesses approach climate risk and opportunity disclosures. The evolving regulatory landscape highlights the importance of aligning business practices with global climate goals and maintaining transparency in sustainability reporting. For U.S. manufacturers, these frameworks offer essential guidance on integrating sustainability into long-term strategies, enhancing competitiveness, and ensuring compliance with international expectations.

Pillar 3

Energy Optimization

3.1

Introduction to Energy Use and Optimization

Industrial energy use is a significant contributor to global energy consumption and GHG emissions.

Improving energy efficiency and implementing projects to transition to more sustainable technologies can contribute to progress towards achieving sustainability goals as well as reduce operational costs. There are a variety of ways that manufacturers can improve the optimization of energy use within their facilities, which can reduce operational costs, minimize waste, and lower utility bills, contributing to progress toward sustainability goals. In the following sections we will discuss projects and technologies that are applicable to the manufacturing sector.

3.2

Energy Efficiency Projects

Projects that improve energy efficiency can help businesses advance their sustainability goals while also providing significant financial benefits.

Implementing energy-efficient technologies and practices reduces greenhouse gas emissions and overall environmental impact, aligning with corporate social responsibility initiatives and enhancing brand reputation. These dual benefits—cost savings and improved sustainability—can lead to increased competitiveness in the marketplace, as consumers and stakeholders increasingly prioritize sustainability. Ultimately, energy efficiency projects represent a strategic investment that supports both financial performance and a commitment to sustainability.

3.2.1 - Compressor Optimization

Compressors are used in a variety of processes such as refrigeration, air conditioning, and industrial processes, can hold significant potential reducing energy consumption when optimized for energy efficiency. Compressor optimization involves enhancing the performance and efficiency of the compressor. Compressor optimization varies depending on specific use case but can be achieved through techniques such as adjusting operating parameters, implementing advanced control strategies, and utilizing more efficient compressor designs. Regular maintenance and monitoring also contribute to optimization. By optimizing compressors, facilities can achieve significant cost savings, lower environmental impact, and extend equipment lifespan and improved system reliability.

Compressed air system optimization can also result in significant energy and cost savings. This may include simple measures such as routine air leak checks, which can result in significant cost savings and help to maintain the compressor systems at optimal conditions. System optimization may also include segregating compressed air systems onto different piping systems operating at different pressures to reduce the number of regulators and the quantity of high-pressure air that may be required.

3.2.2 - Lighting Improvements

Switching to energy efficient lighting is an easy way to save energy as well as reduce costs. High quality products which have the highest energy efficiency ratings can be identified by the ENERGY STAR rating. LED is the most energy-efficient lighting technology currently on the market. Compared to other types of lighting including CFL (compact fluorescent lamp) and incandescent, LED light bulbs last longer, are more durable, and provide equal or better quality of lighting.[7]

[7] energy.gov/energysaver/led-lighting

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How LEDs are Different:

DIRECTIONAL

LEDs are directional light sources, capable of being aimed in a desired direction, eliminating the inefficiencies of traditional lighting which emit light and heat in all directions.

TEMPERATURE

Traditional bulbs can waste up to 90% of energy as waste heat, LEDs by comparison emit very little heat.

LIFETIME

LEDs last up to 5 times longer than CFL and up to 30 times longer than an incandescent bulb.[8]

Because of their high efficiency, improved light quality, and directional nature, LEDs are an effective option for industrial use. Properly designed LED systems provide improved visibility, reduced eye strain, reduced glare and energy savings over other technologies.

In addition, implementing technologies such as timers, occupancy sensors, and dimmers can also improve energy efficiency. Timers can be installed to automatically turn off lights when they are not needed. Occupancy sensors can automatically turn lights on and off when people enter and exit the room. Dimmers can lower the light to the desired level for the task or application.

LEED points for lighting can be gained in the following categories:

LIGHT POLLUTION REDUCTION

DAYLIGHT AND VIEWS

ENERGY PERFORMANCE

INTERIOR LIGHTING QUALITY [9]

CONTROLLABILITY OF SYSTEMS

Task lighting is directed lighting that concentrates light to a particular area. Task lighting is ideal for higher-energy areas that require additional focus such as industrial facilities, warehouses, and offices. LEDs are excellent options for task lighting due to their improved lighting quality, efficiency, and adjustability.[10]

Daylighting is another lighting design which utilizes windows, skylights, and reflective surfaces to provide direct or indirect lighting indoors. Thoughtfully designed daylighting can reduce energy use and provide cost savings.

3.2.3 - Motor Efficiency

Motor efficiency can significantly impact energy consumption in manufacturing facilities and can be improved in several ways including upgrading to high-efficiency motors, implementing variable frequency drives, and ensuring proper maintenance. Improved motor efficiency lowers operational expenses and extends the lifespan of equipment, contributing to reduced maintenance costs and downtime for repairs. Methods to improve motor efficiency include:

High-Efficiency Motors: High-efficiency motors are designed to operate more efficiently under various loads.

Proper Sizing: Ensure motors are appropriately sized for the specific application to avoid overloading or underloading, both of which can reduce efficiency.

Variable Frequency Drives (VFDs): VFDs can be used to control motor speed and torque. Implementing VFDs to adjust motor output to load requirements is an effective way to improve efficiency.

Regular Maintenance: Routine maintenance and inspections keep motors clean, lubricated, and in good working condition. This simple process can contribute positively to energy efficiency.

Use of Soft Starters: Soft starters, used to control the startup of electric motors, help to reduce inrush current and mechanical stress during the initial startup phase. By gradually ramping up voltage and current, allows for smoother acceleration of the motor, helping to extend the life of the motor and connected equipment, minimizing mechanical stress and reducing energy consumption.

Eliminate Voltage Drops: Maintaining proper wiring and connections is an effective way to minimize voltage drops and improve motor efficiency.

Power Factor Correction: Installing capacitors can improve the power factor, reducing the reactive power demand and increasing overall system efficiency.

Load Management: Proper monitoring and management of loads can ensure that motors are running at or near their optimal capacity, contributing positively to energy efficiency.

Heat Recovery Systems: Harnessing waste heat generated by motors through waste heat recovery is an excellent way to improve efficiency. See the following section for a more detailed discussion of waste heat recovery and its potential applications.

Monitor Performance: Energy monitoring systems can be helpful in improving energy efficiency through tracking motor performance and identifying areas for improvement.

[8] energy.gov/energysaver/lighting-choices-save-you-money

[9] images.philips.com/is/content/PhilipsConsumer/PDFDownloads/United%20Kingdom/ODLI20150421_001-UPD-en_GB-leed-brochure.pdf

[10] gelighting.com/inform/accent-task-ambient-lighting-differences

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3.2.4 - Boiler Tuning

Boiler tuning optimizes the performance of boiler systems. Boiler tuning typically includes adjusting parameters such as air-fuel ratios, calibrating controls, and performing regular maintenance. Effective boiler tuning can improve combustion efficiency resulting in reduced emissions and reduced fuel costs. By improving boiler efficiency, businesses can reduce their greenhouse gas emissions, aiding in compliance with environmental regulations, reduce operating costs and extend the lifespan of equipment.

3.2.5 - Waste Heat Recovery

According to the Department of Energy, between 20 and 50 percent of industrial energy input is lost as waste heat. Common sources of waste heat are hot exhaust gases, cooling water, and heat released from hot equipment surfaces and heated products. When harnessed, this waste heat can reduce operational costs and environmental footprint and improve plant efficiency.

Waste heat recovery processes can vary depending on the type of waste heat, temperature and intended application. However, the process typically includes the following elements:

HEAT TRANSFER

During this step, heat is extracted from the source stream via heat transfer facilitated by direct contact, an intermediate surface, or other means to a cooler working fluid or medium.

WORKING FLUID LOOP

A working medium such as water, thermal oil, or a refrigerant is then circulated through the waste heat recovery equipment and the recovered heat is transferred to the point of utilization.

HEAT UTILIZATION

The recovered waste heat can then be used in a variety of ways. Common applications include:

- Generating steam for power production
- Preheating combustion air or process streams
- Space heating or cooling
- Fueling other thermal processes

3.2.6 - Waste Heat to Power

Waste Heat to Power (WHP) systems capture waste heat generated by industrial processes and use it to generate electricity. WHP systems typically generate electricity using turbines or engines powered by the waste heat. Since WHP systems utilize waste heat from an existing industrial process, WHP systems are considered clean energy sources and are an effective way to reduce fossil fuel usage and associated GHG emissions. Depending on the source of the waste heat, WHP systems can be divided into the following three categories[11]:

1 → **Waste heat from a thermal process:**
High-temperature waste heat can be recovered from sources such as boilers, furnaces, ovens, kilns, or other thermal processes. Electricity can be generated from these sources using systems such as a Rankine cycle steam turbine. Lower temperature waste heat can also be recovered from thermal systems and processes and converted to electricity through other technologies, such as the organic Rankine cycle coupled with turbines or reciprocating engines.

2 → **Waste heat from a mechanical drive:**
Processes that use mechanical drive equipment such as engines and turbines can also generate electricity through the recovery of low-temperature waste heat. Existing equipment can be used to drive mechanical shafts that, in turn, spin compressors, pumps, and electrical generators. For example, a pipeline compressor station may use a gas turbine to drive a compressor to move natural gas through a pipeline. In this example, low-temperature waste heat can be recovered from the gas turbine exhaust using organic Rankine cycle technology, which can then be used to generate electricity.

3 → **Waste heat from other systems:**
Heat that is generated as a byproduct of industrial processes can also be used in WHP systems. Examples of such processes include exothermic reactions (e.g., fertilizer manufacturing), incineration of sewage sludge, and heat released from pressure relief valves (PRVs).

According to the U.S. DOE Office of Energy Efficiency and Renewable Energy, South Carolina had developed 1,375 megawatts of Combined Heat and Power (CHP), across 24 sites by 2017, with the potential to deploy another 3,063 megawatts across more than 4,000 industrial, and commercial or institutional facilities. These sites potentially include “topping cycle” CHP, waste heat to power CHP and district energy CHP applications.[12]

The EPA provides an Excel-based CHP Screening Tool to help facility managers and end-users who are beginning to consider the potential for CHP applications.[13] The tool provides a preliminary economic feasibility assessment based on annual energy consumption to estimate the size and economic performance of a potential CHP system.

[11] betterbuildingssolutioncenter.energy.gov/sites/default/files/attachments/Waste_Heat_to_Power_Fact_Sheet.pdf

[12] betterbuildingssolutioncenter.energy.gov/sites/default/files/files/tools/South%20Carolina.pdf

[13] epa.gov/chp/my-facility-good-candidate-chp

3.3

Energy Audits

A valuable first step in improving energy efficiency is to conduct an energy efficiency audit.

Energy efficiency audits can be used in a broad range of settings to identify opportunities to improve energy efficiency. Facilities of any industry or scale can benefit from an energy efficiency audit. However, the level of effort involved, and the level of energy management expertise required, will obviously vary widely across this range. In general, the field of energy management recognizes four basic levels of energy efficiency audits: Benchmarking, Level 1, Level 2, and Level 3 audits. Each of these levels have specific characteristics, which are discussed below.

3.3.1 - Benchmarking Audit or "Preliminary Energy Audit"

A benchmark audit also known as a "Preliminary Energy Audit" includes:

- May or may not require a site visit.
- Utilizing existing actual energy use records from utility bills or other sources.
- Calculating benchmark values such as Energy Use Index (EUI) and Energy Cost Index (ECI).
- Comparing actual energy use to normative values, such as DOE's ENERGY STAR Portfolio Manager.
- Facility performance comparison to averages for the type of facility or process.

3.3.2 - Level 1 – "Walk-Through Audit"

A Level 1 audit may also be known as a "Walk-Through Audit." As the name implies, this audit is conducted fairly quickly and can identify simple or easy-to-implement opportunities or energy conservation measures (ECMs). This walk-through may also identify opportunities where further data gathering or engineering may be required in order to achieve greater potential energy savings and GHG reductions. The characteristics of a Level 1 audit include:

- An on-site visual inspection and review of prior audits or actions. Typical audits require 1-3 days, depending on facility complexity and size.
- A review of operation and maintenance practices to identify any issues and opportunities for improvement.
- Identification of "No-Cost" or "Low-Cost" opportunities for improvement.
- Rough estimates of potential costs for implementation and potential savings.

3.3.3 - Level 2 – "Energy Survey & Analysis"

A Level 2 audit requires additional data collection and provides a higher level of detail and engineering analysis than a Level 1 audit. A Level 2 audit can potentially identify ECMs that may cost more to implement but can result in greater savings and decarbonization potential. The characteristics of a Level 2 audit include:

- Multiple on-site and remote components, over a short term (weeks to months).
- Measurements and data collection, potentially using temporary meters or data logging equipment.
- An energy use breakdown at the facility or building by use category and energy type.
- A review of operation and maintenance procedures in detail, including:
- Qualitative assessment of maintenance practices
- Review of set points, operating schedules, start-up, shutdown, and idling practices, etc.
- A detailed savings and cost analysis of potential projects, including estimated energy use according to equipment size, loads, rated efficiency, hours, etc. This analysis also includes recommendations.
- Identifies capital-intensive ECMs or improvements that may require further analysis.

3.3.4 - Level 3 – Detailed Analysis of Capital-Intensive Projects

The Level 3 audit is the most intensive effort since it requires the most data collection and provides a higher level of detail and engineering analysis than a Level 2 audit. Typically, a Level 3 audit is limited to the evaluation of capital-intensive projects that require capital funding and will have relatively long implementation times. The characteristics of a Level 3 audit include:

- A focus on selected capital-intensive opportunities.
- Data collection, which will likely include detailed field data, quotes from equipment vendors, and may include computer modeling of the options.
- Project life-cycle cost analysis and risk assessment of options.
- A detailed project cost and savings analysis with a level of confidence to make major capital investment decisions and include in capital investment requests, either from banks or other capital sources.

3.4

Benefits of Energy Efficiency Audits

As previously stated, energy efficiency is the best first step toward facility decarbonization and energy savings.

Energy efficiency audits are an excellent way to reduce GHG emissions and save money on energy expenditures. When performed sequentially to address opportunities of increasing complexity and increasing improvement potential, energy efficiency audits are a cost-effective means to improve financial and sustainability performance. Conducting these audits can also improve production performance, employee comfort, and reduce indirect costs.

3.5

Building Envelope

The building envelope refers to the physical barrier between the interior and exterior of a building, comprised of the walls, roof, windows, and foundation.

The building envelope significantly impacts regulation of indoor climate, providing insulation, and protecting against the elements. A well-designed building envelope enhances energy efficiency by minimizing heat loss in the winter and heat gain in the summer, ultimately reducing heating and cooling costs. Windows, skylights, and other features can be strategically placed to reduce artificial lighting needs, see the previous section on lighting improvements for more detail. Additionally, a thoughtfully designed building envelope can contribute to occupant comfort and indoor air quality by controlling moisture and airflow. By investing in high-performance materials and construction techniques for the building envelope, organizations can achieve significant energy savings, lower operational costs, and create healthier living and working environments for employees, all of which can contribute meaningfully to a business's sustainability goals.

An energy efficient building envelope can be achieved through:

- Selecting durable materials with a long life to reduce the need for replacement and resulting waste.
- Sourcing materials locally, when possible, to reduce GHG emissions associated with transportation.
- Incorporating passive solar design to provide heating and/or open ventilating to provide cooling.
- Leveraging windows and skylights to provide natural lighting.
- Selecting appropriate insulation to reduce heating and cooling needs.
- Incorporating reused or recycled building materials.
- Effective air flow control, preventing drafts and moisture, limiting outdoor pollutants.
- High-performance window features, ex: triple glazing, low-emissivity coatings, and dynamic glazing.
- Use of HVAC systems to improve indoor air quality and control germs.

While the design and construction of new buildings presents the best opportunity to maximize the sustainability of the building envelope, significant improvements can also be made during renovations or modifications to existing facilities.

3.6

Solar and Other Renewables Feasibility

The adoption of solar and other renewable energy sources presents a significant opportunity for industrial facilities to improve sustainability and reduce energy costs.

Solar energy in particular has expanded due to the state's abundant sunlight and policies supporting renewable energy, including tax incentives and net metering programs. By installing solar panels, industrial facilities can generate renewable electricity, lowering their dependence on fossil fuels and reducing GHG emissions. In addition to solar, other renewable energy sources, such as wind, biomass, and hydropower, can be implemented in industrial facilities depending on the location of the facility and its energy needs. For example, biomass energy can be harnessed from agricultural byproducts or waste, providing an alternative fuel source while reducing waste sent to a landfill.

Manufacturing facilities can adopt renewable energy in several different ways. One way is to construct onsite renewable energy generation such as installing solar panels on rooftops, over parking lots, or on unused land to generate electricity. By taking advantage of state incentives and federal tax credits, manufacturers can offset installation costs and benefit from reduced utility bills over time. Additionally, depending on the facility, some businesses may consider on-site biomass energy systems, utilizing organic waste or byproducts as fuel. This provides an alternative energy source and helps in waste management and resource recovery. In addition to the installation of onsite renewable energy, facilities can explore PPAs with renewable energy developers. This allows businesses to procure alternative energy from off-site renewable energy facilities at a fixed rate, providing price stability and supporting large-scale renewable projects without the upfront capital investment.

Lastly, participating in community solar programs allows businesses to invest in local solar projects and receive credits on their energy bills without needing to install their own systems. Through the use of any one or a combination of the ways to adopt renewable energy, manufacturers can reduce their reliance on fossil fuels, lower their GHG emissions, and make progress towards their sustainability goals.

3.7

Cost Reduction Strategies

As governments around the world adopt goals and implement policies to reduce emissions and transition away from fossil fuels, energy prices have risen.

As energy prices fluctuate, manufacturers are increasingly seeking innovative approaches to manage their energy consumption and minimize expenses. Two effective strategies that can lead to significant savings are demand response programs and the integration of renewable energy efficiency measures. Through demand response, facilities can adjust their energy usage during peak times to lower costs. Implementation of renewable energy solutions reduces reliance on traditional energy sources while reducing emissions and contributing positively towards sustainability goals.

3.8

Demand Response

Demand response (DR) is a cost reduction strategy that allows businesses to adjust their energy consumption in response to fluctuations in energy demand or price signals from utility providers.

By participating in demand response programs, facilities can reduce or shift their electricity use during peak periods when energy demand and costs are highest. Demand response helps stabilize the grid, improving overall efficiency and also enables businesses to take advantage of financial incentives offered by utility providers.

For instance, during times of peak demand, a facility could reduce non-essential processes, optimize machinery operation, or utilize on-site energy storage if this is an option. Demand response can significantly lower energy bills, as businesses can avoid higher rates during peak times and receive payments or credits for their participation in DR programs. Adopting demand response can also contribute to improved operational efficiency, as facilities often identify opportunities to streamline processes and reduce waste during these energy-saving initiatives. Energy efficiency audits can be a great tool in this process and are discussed further in the previous section. Overall, DR is an effective cost reduction strategy, helping manufacturing facilities enhance their financial performance while contributing to a more stable and sustainable energy system.

3.9

Renewables Efficiency

Implementing renewable energy is an effective cost reduction strategy for manufacturing facilities.

By harnessing energy from renewable sources such as solar, wind, or biomass, manufacturers can significantly reduce their reliance on conventional fossil fuels, leading to lower energy expenses and greater energy independence.

One approach is to install on-site renewable energy systems, such as solar panels or wind turbines, which can generate electricity to power manufacturing processes. This helps to reduce energy bills while also insulating facilities from volatile energy prices. Additionally, many manufacturers can take advantage of government incentives, tax credits, and rebates, reducing the initial investment costs associated with renewable energy adoption. Incorporating energy-efficient technologies, such as high-efficiency motors, variable frequency drives, and advanced energy management systems, increases the overall effectiveness of renewable energy use. These technologies ensure that the energy generated is utilized efficiently, minimizing waste and maximizing production efficiency. Additionally, manufacturers can explore energy storage solutions to capture and store excess renewable energy generated allowing it to be used during peak demand times. Energy storage solutions can help in balancing energy supply and demand and also contribute to cost savings by allowing facilities to avoid high utility rates during peak hours.

Renewable energy solutions can lower operating costs while also supporting sustainability initiatives, making it a strategic investment for manufacturing facilities looking to improve their financial performance while reducing their environmental impacts.

Pillar 4

Waste Stream Reduction

Understanding and managing waste streams is important as it directly influences sustainability and operational efficiency. Waste streams refer to the entire flow of waste from its source through recovery, recycling, or disposal. By gaining a comprehensive understanding of one's waste generation, manufacturers can pinpoint inefficiencies and improve resource utilization, which can lead to lower costs, decreased environmental impacts, and optimized production processes. This conserves raw materials and helps reduce energy consumption and the environmental degradation associated with resource extraction and waste disposal.

Proper waste stream management also supports regulatory compliance, environmental protection, and long-term economic benefits. Reducing, reusing, and recycling waste can significantly lower landfill fees and waste treatment costs, while providing opportunities for repurposing materials that would otherwise be discarded. Implementing waste stream strategies contributes to a circular economy, creating closed-loop systems where waste is minimized, and resources are reused. Understanding waste streams is a vital step in reducing environmental footprints and enhancing sustainability efforts that ultimately improve competitiveness and corporate responsibility.

4.1

Waste Stream Types

It is important to understand the amount of each type of waste being generated, as there are many different waste stream types that stem from the manufacturing industry.

Below is a list of the main waste types, each of which contains subcategories for specific waste streams:

MUNICIPAL SOLID WASTE

Everyday items discarded in the public municipal waste system, including household waste, food scraps, and basic recyclables.

COMMERCIAL AND INDUSTRIAL WASTE

Waste generated from industrial activities, including office waste, packaging materials, and manufacturing by-products.

CONSTRUCTION AND DEMOLITION WASTE

Waste is generated from construction, renovation, and demolition debris, including concrete, wood, metals, and bricks.

LIQUID WASTE

All liquid waste, including sewage, trade waste, wastewater, and even hazardous liquids.

HAZARDOUS WASTE

Any waste that poses a substantial threat to public health and the environment, including batteries, solvent waste, pesticides, and medical waste. There are Federal and State regulations around hazardous waste handling and disposal methods.

4.2

Waste Management

Proper handling and disposal of waste prevents any accidental release of hazardous substances, reduces the amount of waste sent to the landfill, and protects the surrounding community and environment.

There are a few waste management methods which are described below:

Landfill	One of the most traditional waste disposal methods where waste is buried in designated sites. While these sites are active, the decomposition of the waste generates high levels of methane, which is a potent GHG gas. Although some landfills are designed with liners and gas collection systems to minimize environmental impact, landfilling has more negative environmental impacts than other methods of waste disposal.
Incineration	Burning waste at high temperatures reduces its volume and sometimes generates energy. It is particularly useful for hazardous and medical waste. Since this method produces air pollution, there are specific regulations that must be followed.
Recycling	Waste is reduced through the processing of waste materials (e.g., metals, plastic, and paper) to create new products. Recycling helps conserve natural resources and reduce energy consumption.
Composting	Organic waste, such as food scraps and yard waste, decomposes naturally to produce compost, which can be used to enrich soil. This process reduces landfill use and GHG emissions while recycling essential nutrients back into the ecosystem. Manufacturers in South Carolina should explore onsite and/or facility-based composting to manage their organic waste.
Waste-to-Energy (WTE)	Incineration and anaerobic digestion are two of several methods that can be used to convert non-recyclable waste materials into usable heat, electricity, or fuel. While WTE reduces waste volume and generates energy, it still produces emissions and should be carefully managed to balance efficiency with sustainability.

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Recovery and Reuse	Recovering useful materials from waste and reusing them minimizes raw material extraction and conserves resources. Examples include rare earth metal recovery from electronic waste and scrap metal reusing construction materials.
Anaerobic Digestion	Breaking down organic waste using bacteria in the absence of oxygen produces biogas and digestate, which can be used as a renewable energy source and fertilizer, respectively. This method helps reduce landfill waste and can produce renewable energy, making it a valuable addition to waste management strategies.
Wastewater Treatment	Removing contaminants from water that has been used in homes, industries, and businesses, makes it safe to release back into the environment or reuse.
Hazardous Waste Disposal	Specialized methods are used for disposing of hazardous materials, such as chemical treatment, encapsulation, and secure landfilling to limit environmental exposure. This method is needed to safely dispose of hazardous materials such as chemicals and electronic waste.

4.2.1 - Landfills

There are many ways to manage waste, as indicated above, but it is important to evaluate the best method for disposal by considering overall environmental impact. Landfilling has a significant negative impact due to the generation of methane, harmful leachate affecting the surrounding community, impacts on air quality, and the ending of a product's life cycle which wastes raw materials that could have been reused. Limited oxygen availability, in the decomposition process, leads to a larger generation of methane, a GHG 25 times more potent than carbon dioxide. The limited oxygen environment increases the time required for waste to decompose and some inorganic materials will take hundreds of years to fully decompose. Modern landfills now have a liner that attempts to prevent hazardous substances from leaching into the soil and drinking water. Leachate can carry harmful chemicals and heavy metals that can be detrimental to the surrounding environment. Landfills also negatively impact air quality in the surrounding area due to the decomposition of organic matter, producing air contaminants like hazardous air pollutants (HAP), particulate matter (PM), and volatile organic compounds (VOC).

4.2.2 - Incineration

Incineration involves the burning of waste at high temperatures. Incineration significantly reduces the volume of waste but also produces carbon dioxide and other criteria air pollutants. Hazardous waste, municipal solid waste, and medical waste are common waste streams that are incinerated. Incineration does not completely remove waste, so it is not a solution to the waste generation problem. Incineration is necessary for some hazardous substances and medical waste to remove pathogens. A drawback to incineration is that the burning of waste at high temperatures produces CO_2 and other air pollutants.

4.2.3 - Recycling

Recycling is a good alternative to the landfill for certain materials such as paper, metals (specifically aluminum), glass, and some plastics. While recycling is not the best method to reduce waste, it effectively conserves materials and reduces the energy-intensive process of raw material extraction. Recycling materials takes a lot of energy which in turn produces GHG emissions, these processes are continuously improving to reduce energy consumption. Not all materials are treated the same when recycling. Metals like aluminum for example are highly valuable when recycled and do not deteriorate over time. While only certain types of plastics can be recycled, and plastic deteriorates each time it goes through the recycling process which means it needs to be "down cycled" to a lower quality plastic. The ability to recycle some materials is also subject to where your company operates, local recycling capabilities, and local laws.

4.2.4 - Composting

Composting is a great way to recycle nutrients from organic waste back into the environment. Composting converts organic waste, like food scraps and paper products, to nutrient rich soil that can be returned to the environment. By allowing these materials to decompose naturally in a controlled environment, composting reduces the volume of waste sent to landfills and lowers greenhouse gas emissions. Additionally, composting helps recycle essential nutrients back into the ecosystem, promoting a more sustainable and circular approach to waste management. Composting can be done at home, or at large composting facilities that increase the temperature in the compost environment to compost more products, such as compostable plastics.

4.2.5 - Waste-to-Energy (WTE)

WTE is a waste management method that incinerates waste and converts energy through the combustion process. The heat from the combustion process is used to produce electricity. This method is more efficient than simple incineration since the excess heat is not lost, and energy is recovered. Waste to energy still produces criteria air pollutants and GHG emissions, which are large drawbacks of the process and do not promote circularity. Criteria air pollutants are common air pollutants that the EPA regulates under the Clean Air Act.

4.2.6 - Recovery and Reuse

Recovery and reuse of waste is highly promoted in a circular economy and are essential components of waste management that focus on extracting valuable materials from waste and repurpose them. This method involves identifying and separating materials that can be reused or recycled, such as metals, plastics, and glass, from the waste stream. These materials are then processed and transformed into new products, reducing the need for virgin resources and minimizing environmental impact. By prioritizing recovery and reuse, we can significantly reduce landfill use, conserve natural resources, and promote a circular economy. Additionally, energy recovery processes, such as incineration with energy capture, convert non-recyclable waste into usable heat, electricity, or fuel.

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4.2.7 - Anaerobic Digestion

Anaerobic digestion is an effective waste management method that involves breaking down organic waste materials, such as food scraps, manure, and sewage sludge, in the absence of oxygen. This process is carried out by microorganisms in a controlled environment, typically within a sealed tank called a digester. The primary outputs of anaerobic digestion are biogas, a renewable energy source composed mainly of methane and carbon dioxide, and digestate, a nutrient-rich substance that can be used as a fertilizer. This method not only helps in reducing the volume of waste sent to landfills but also mitigates GHG emissions and recycles valuable nutrients back into the soil, promoting a more sustainable waste management system.

4.2.8 - Wastewater Treatment

Wastewater treatment involves removing contaminants from wastewater to protect public health and the environment. This process typically includes several stages: preliminary treatment to remove large debris, primary treatment to settle out solids, secondary treatment using biological processes to degrade organic matter, and tertiary treatment to further polish the effluent by removing nutrients and other pollutants. The treated water, or effluent, can then be safely discharged into natural water bodies or even reused for various purposes, such as irrigation or industrial processes. Additionally, the sludge generated during treatment can be processed and used as fertilizer or for energy production, making wastewater treatment a sustainable approach to managing waste and conserving resources.

4.2.9 - Hazardous Waste Disposal

Hazardous waste disposal involves careful handling, treatment, and disposal of materials that pose a significant risk to human health and the environment. These materials can include chemicals, batteries, pesticides, and electronic waste. Proper disposal methods include incineration, chemical treatment, and secure landfilling, all designed to neutralize harmful substances and prevent contamination of soil, water, and air. Specialized facilities and protocols ensure that hazardous waste is managed safely, reducing the potential for accidents and environmental damage. This process is crucial for maintaining public health and environmental integrity. E-waste, specifically in South Carolina, has some specifics outlined in the section below.

4.2.10 - E-Waste

E-waste, or electronic waste, refers to discarded electronic devices and equipment such as computers, smartphones, televisions, tablets, etc.. As technology rapidly evolves, the lifespan of these devices shortens, leading to an increase in e-waste. This type of waste poses significant environmental and health risks due to the presence of hazardous materials like lead, mercury, and cadmium. Improper disposal can lead to soil and water contamination, affecting ecosystems and human health. Recycling and proper disposal of e-waste are crucial to mitigating these risks. Additionally, promoting the repair and reuse of electronic devices can help reduce the volume of e-waste generated. Addressing e-waste is essential for sustainable development and environmental protection. South Carolina passed electronics legislation (S.C. Code of Laws §§ 48-60-05 et seq.) in 2010 that banned the disposal of specific electronics in solid waste landfills effective July 1, 2011. One key component of the legislation requires residents to recycle computers, computer monitors, printers and televisions. Information on how to recycle e-waste in South Carolina is located on the South Carolina Department of Environmental Conservation (DHEC) website.

4.3

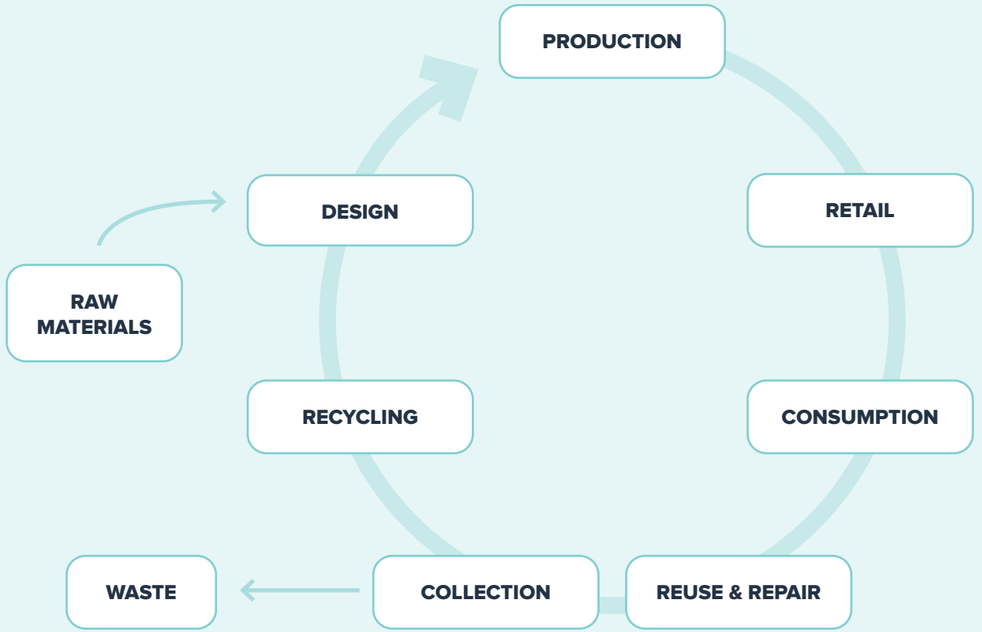
Zero Waste and Circularity

Currently the United States is in a linear economy, also known as a “take-make-waste” economy.

In this system, materials are extracted from the environment, used and then discarded. To move towards a sustainable future, we need to shift our economy to a more circular economy and keep products, materials, and resources in use for as long as possible. This can be accomplished by reusing, recycling, repairing, and refurbishing existing materials and products. The three core principles to a circular economy are eliminating waste, keeping products in use, and regenerating natural systems.

FIGURE 6-1

Circular Economy



4.4

Waste Reduction Strategies

Waste reduction stands as a critical objective for manufacturers aiming to minimize their environmental footprint and enhance operational efficiency.

A comprehensive waste reduction strategy addresses the disposal of waste and focuses on optimizing processes and resource utilization to prevent waste generation at its source. This section will discuss potential ways to reduce waste in the manufacturing process.

4.4.1 - Recycling Analysis and Material Optimization

A good way for manufacturers to begin a circular economy journey is to conduct a waste audit to analyze the company's waste streams. Here's a summary of the process:

1 **Assemble a Cross-Functional Team and Set a Date**

Gather a team from various departments and choose a timeframe for the audit. Ensure the team includes representatives from finance, health and safety, and custodial staff. Ideally, reviewing a week's worth of waste will provide a reasonable analysis.

2 **Review Objectives**

Make sure all members are aligned on the purpose of the audit and the importance of detailed record keeping.

3 **Gather Equipment**

Collect necessary tools such as clear garbage bags, labels, markers, protective clothing, weighing scales, and a checklist or digital device for recording data.

4 **Sort the Waste**

On the audit day, collect and sort waste into categories (e.g., iron and steel, copper, aluminum, wood, paper, plastic, food waste). Weigh each category and record the data. Weigh the total waste produced by your organization.

5 **Analyze the Results**

Calculate the diversion rate, which measures the percentage of waste diverted from landfills through recycling or composting. Identify areas for improvement based on the audit findings. The diversion rate is calculated by dividing the recyclable waste by Total waste, then multiply by 100 to arrive at the percentage of waste that can be diverted.

6 **Identify Improvement Opportunities**

The most important step is to identify which aspects of waste management can be improved. What identified waste is recyclable but is not currently being recycled? What can be reused, sold as scrap or donated? Are certain departments generating more waste than others? Have you contacted your municipal or county waste management to see what else they will take? Do you need to establish collection areas and manage delivery to their facility if they do not pick up?

7 **Communicate the Results**

Share the audit results with the entire organization. Highlight key findings and areas for improvement to encourage better waste management practices.

The last step is to establish better waste management practices to include recycling, changing raw materials, limit packaging, or changing product design–all to avoid sending waste to the landfill. Recycling and waste management is highly dependent on the municipality, and it is important for manufacturers to check local waste management authorities for specifics. South Carolina has a Smart Business Recycling Program which helps business implement effective recycling practices and reduce waste. The South Carolina Smart Business Recycling Program is a free, confidential initiative designed to help businesses reduce their environmental impact. Here are the key components:

Technical Assistance: The program provides support to start or expand waste reduction and recycling efforts. This includes phone/email consultations, site visits, and workshops

Waste Audits: Businesses can receive help with analyzing their waste streams to identify opportunities for waste reduction and recycling.

Educational Resources: The program offers materials and training sessions to educate employees about proper recycling practices.

Recognition: Businesses that excel in their recycling and sustainability efforts can apply for annual awards, gaining statewide recognition.

Tracking and Reporting: The program helps businesses monitor their recycling performance and report data for the South Carolina Solid Waste Management Annual Reports.

This initiative helps businesses operate more sustainably and provides potential cost savings and enhances their community reputation.

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The South Carolina Department of Commerce provides recycling assistance through their Recycling Market Development staff. (Recycling in SC) The SC Recycling Markets Directory lists over 300 South Carolina recycling companies, allowing manufacturers to easily find recyclers in their area. The SC Commerce site also provide information about the SC Material Exchange, a free online matchmaking tool that connects buyers and suppliers of hard-to-recycle materials.

4.4.2 - Lean Manufacturing

Lean manufacturing is a strategic approach designed to reduce waste, improve efficiency, and enhance value in manufacturing processes. Manufacturers that adopt lean manufacturing can significantly optimize operations while reducing environmental impacts and lowering costs. The primary goal of lean manufacturing is to maximize value for customers by eliminating non-value-added activities, known as waste, within the production process. Key elements of lean manufacturing that align with sustainability goals include:

JUST-IN-TIME (JIT) PRODUCTION

This practice involves producing materials and products only as they are needed, minimizing excess inventory and reducing storage costs. By avoiding overproduction, manufacturers can reduce energy use, raw material consumption, and waste.

CONTINUOUS IMPROVEMENT (KAIZEN)

Lean manufacturing promotes a culture of ongoing improvement where all employees are encouraged to identify inefficiencies and suggest improvements. This hands-on, collaborative approach fosters innovation and ensures processes are regularly evaluated and refined for optimal performance.

VALUE STREAM MAPPING

This tool allows manufacturers to visualize and analyze the flow of materials and information through the production process. By identifying bottlenecks and inefficient steps, manufacturers can work to streamline operations, reduce lead times, and enhance overall productivity.

WASTE REDUCTION

Lean manufacturing focuses on eliminating various types of waste, such as overproduction, excess motion, and defects. Reducing these forms of waste contributes to more sustainable practices, lowers material costs, and improves resource efficiency, benefiting both the environment and the bottom line.

OVERALL EQUIPMENT EFFECTIVENESS

Overall Equipment Effectiveness (OEE) is a key performance indicator for many manufacturing companies that measures how effectively manufacturing equipment is utilized. There are three key factors: machine availability, performance, and quality of output. Increasing OEE can help limit the amount of waste generated from the manufacturing process. By improving OEE, manufacturers can achieve sustainability benefits such as:

- Optimizing Throughput
- Reducing Scrap
- Increasing Machine Uptime
- Enhancing Product Quality

Through these methods, manufacturers can boost operational efficiency, reduce waste, and lower costs, while supporting sustainability initiatives. This approach enhances competitiveness and ensures that manufacturers remain leaders in adopting innovative, resource-efficient production methods.

4.5

Resource Recovery Benefits and Circularity Objectives

In today's manufacturing landscape, the shift toward sustainable practices is more crucial than ever.

Focusing on resource recovery and circularity offers an innovative path to reducing waste, conserving natural resources, and enhancing operational efficiency. By embracing these principles, manufacturers can both improve their bottom line and contribute to a more sustainable future.

RESOURCE RECOVERY

This process involves extracting valuable materials or energy from waste, turning discarded items into useful inputs for new products or processes. By recovering materials that would otherwise go to landfills, manufacturers can minimize waste disposal costs, reduce the consumption of raw materials, and lower GHG emissions. Recovery efforts conserve finite resources and create economic opportunities by reintroducing materials back into the production cycle.

CIRCULARITY OBJECTIVES

Circularity is about creating a closed-loop system where materials, products, and resources are continuously reused, refurbished, and recycled. This approach moves beyond the traditional "take, make, dispose" model and emphasizes product design that considers the entire lifecycle. For manufacturers, circularity means adopting strategies that extend the lifespan of materials, reduce the need for virgin resources, and improve resource efficiency.

By aligning with resource recovery and circularity objectives, manufacturers can significantly reduce their environmental footprint while enhancing sustainability. Implementing these waste reduction practices can lead to cost savings, operational improvements, and greater resilience in the face of changing market and regulatory demands. Together, resource recovery and circularity provide a comprehensive strategy to address waste, conserve resources, and promote a more sustainable and economically viable manufacturing ecosystem. By embracing these principles, we can pave the way for a future where waste is minimized, resources are optimized, and the health of our planet is safeguarded for generations to come.

4.5.1 - Extended Product Responsibility

EPR is a policy framework that holds companies responsible for the end-of-life management. EPR aims to encourage companies to design products with their entire lifecycle in mind, ensuring that they are either recyclable, reusable, or disposed of in an environmentally friendly manner. This approach includes both financial and operational responsibilities, requiring companies to facilitate the processing of their products after consumer use. As of now, EPR regulations are primarily enforced for specific product categories, such as paints and electronics, in ten states across the U.S. not including South Carolina. These regulations require manufacturers to develop and implement systems for collecting and recycling their products once they reach the end of their useful life, which will become increasingly relevant to manufacturers as time progresses. While the current scope of EPR is limited, the movement is gaining traction, with increasing advocacy for its adoption across a wider array of products and industries.

4.5.2 - Supply Chain Localization

A core part of circularity is optimizing a business's supply chain. Supply chain localization refers to purchasing locally manufactured products and components to reduce shipping, which can help decrease associated GHG emissions due to the reduction in fuel consumption. Localizing suppliers may offer opportunities to utilize returnable packaging that can be reused multiple times vs. being discarded after a single use, allowing for a more circular economy.

Benefits of supply chain localization include:

- Reduced GHG Emissions
- Waste Reduction through Packaging Optimization
- Enhanced Responsiveness and Flexibility
- Support for Local Economies
- Improved Supply Chain Resilience

4.6

Zero Waste

Zero waste is a set of principles focused on waste prevention, aiming to redesign resource life cycles so that all products are reused or repurposed, and nothing is sent to landfills, incinerators, or the environment.

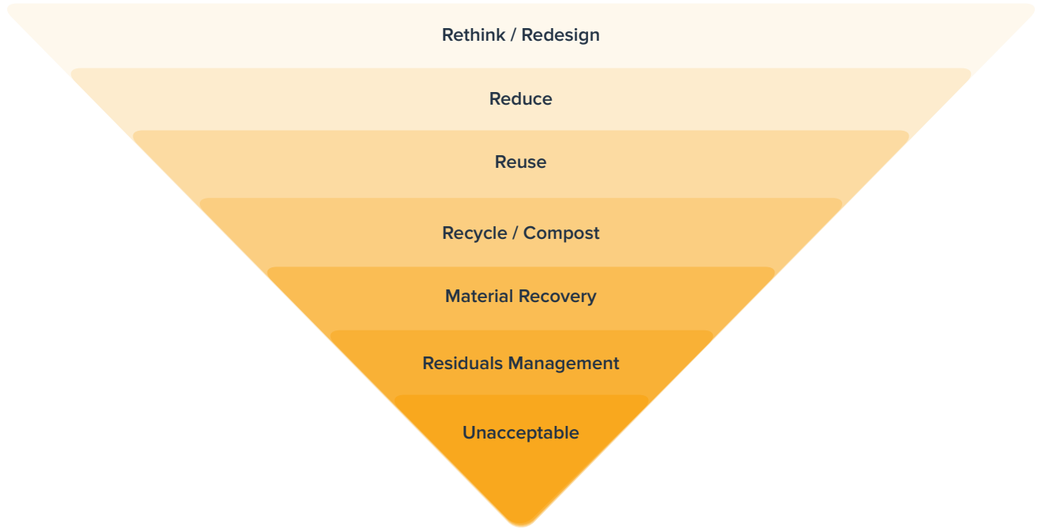
The goal is to minimize waste production as much as possible and then compost, reuse, or recycle any remaining waste.

4.6.1 - Methodology

The Zero Waste methodology's goal is to eliminate waste being sent to landfills or incineration. This involves circularity design and resource management. The hierarchy to how to move toward zero waste is shown in Figure 5-2. The Zero Waste Hierarchy outlines a progression of policies and strategies that support a Zero Waste system, prioritizing the highest and best use of materials. It serves as a guide for developing systems or products that move us closer to Zero Waste.

FIGURE 6-2

Zero Waste Hierarchy



The tiers of the zero-waste hierarchy are:

1	**Rethink/ Redesign**	Focus on systemic changes to avoid wasteful consumption and design products for durability, repairability, and recyclability.
2	**Reduce**	Minimize the amount of waste generated by consuming less and choosing products with minimal packaging.
3	**Reuse**	Extend the life of products by reusing or repurposing them for new uses.
4	**Recycle/ Compost**	Process materials to make new products or compost organic waste to return nutrients to the soil.
5	**Material Recovery**	Extract energy from waste materials that cannot be reused or recycled.
6	**Residual Management**	Manage waste that cannot be processed in the other systems through stabilizing fermentable materials to reduce emissions and leachate, planning infrastructure to adapt to fewer residuals over time, and managing existing landfills.
7	**Unacceptable**	Waste that is unacceptable through the Zero Waste framework. This includes incineration and waste-to-energy systems.

To properly use the Zero Waste hierarchy, it is important to prioritize the higher tier methods over the lower tiers. Unfortunately, many organizations emphasize the lower tiers of the waste management hierarchy, resulting in costly systems designed to destroy materials rather than effectively manage resources and reduce environmental impacts.

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4.6.2 - Implementation

Effectively adopting Zero Waste strategies requires a comprehensive approach that tackles multiple facets of business operations. The first strategy in the implementation of zero waste principles is looking upstream of the process by using sustainable procurement practices. Sustainable procurement is a business practice that analyzes the supply chain to procedure materials that are high quality, less packaging, and promotes sustainability and environmental responsibility. The second strategy is reducing waste at the source. This involves redesigning packaging, implementing lean manufacturing principles, and exploring new technologies that are more resource efficient. The final strategy is the root to a circular economy: having circular design in mind when developing products. This involves adopting a mindset that the product has a life beyond its initial use and creating a closed loop system. Zero waste strategies require a holistic approach to addressing all aspects of zero waste which can lead to a regenerative business model.

4.6.3 - Benefits

The Zero Waste methodology offers numerous benefits for individuals, communities, and the environment including:

ENVIRONMENTAL PROTECTION

By minimizing waste, Zero Waste practices reduce pollution, conserve natural resources, and mitigate climate change. This approach helps decrease the amount of waste sent to landfills and incinerators, reducing greenhouse gas emissions and other pollutants.

RESOURCE CONSERVATION

Zero Waste promotes the efficient use of resources by encouraging recycling, reusing, and composting. This reduces the need for raw materials, conserving natural resources and energy.

ECONOMIC SAVINGS

Reducing waste can lead to significant cost savings for businesses and households. By reusing and recycling materials, individuals and organizations can lower their expenses on raw materials and waste disposal.

JOB CREATION

Recycling and composting create more jobs compared to landfill disposal. The Zero Waste approach supports local economies by generating employment opportunities in the recycling and waste management sectors.

IMPROVED PUBLIC HEALTH

Reducing waste and pollution leads to cleaner air and water, which can improve public health. Zero Waste practices also encourage the use of non-toxic materials, reducing exposure to harmful chemicals.

ENHANCED COMMUNITY WELL-BEING

Zero Waste initiatives can strengthen community ties by involving residents in local sustainability efforts. These initiatives often include educational programs and community events that promote environmental awareness and collective action.

By adopting Zero Waste practices, we can create a more sustainable and resilient future for ourselves and the planet.

Pillar 5

Data and Supply Chain

Accurate and reliable data is the cornerstone of effective sustainability management and accurate reporting, especially for manufacturers navigating the complexities of supply chain operations. As manufacturers increasingly prioritize transparency and accountability in their sustainability efforts, the quality of the data used to track performance becomes essential. Primary data, collected directly from operations, offers far greater accuracy and specificity than secondary data, which often relies on estimates or third-party sources. By emphasizing the use of primary data, manufacturers can measure real impacts, set precise sustainability targets, and drive meaningful improvements. This approach ensures that the reported information is reliable and can be verified with a high level of confidence.

In today's manufacturing landscape, digital solutions and automation are valuable tools for manufacturers to gather real-time, high-quality primary data, improving accountability across their operations and supply chain. Automated systems enhance data accuracy, streamline reporting processes, and facilitate continuous monitoring of sustainability performance. This allows manufacturers to adopt a proactive approach to decarbonizing their operations.

Pillar 5 of the SRG explores why efficient data gathering and reporting, especially the ability to gather primary data from various data sources utilizing digital systems, is essential for companies striving for sustainability leadership. Accurate and comprehensive data collection, particularly for quantifying GHG emissions from operations and the supply chain, is a critical step in corporate decarbonization, setting the foundation for informed decision-making and long-term sustainability goals.

5.1

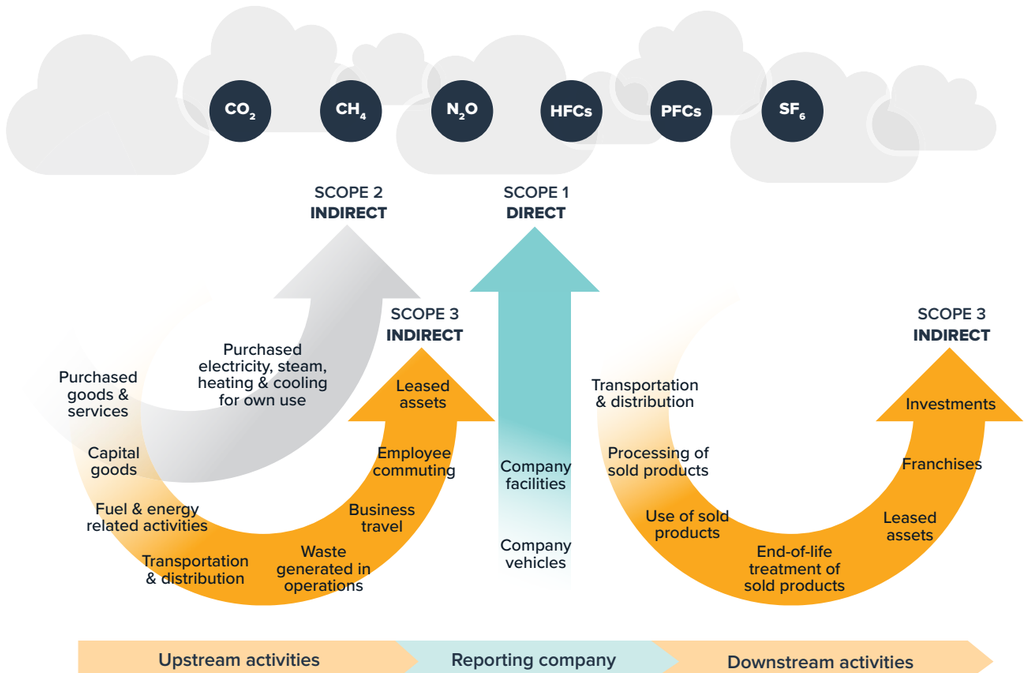
Carbon Footprint and Greenhouse Gas Emissions

5.1.1 - The Importance of Calculating Your Carbon Footprint

Calculating your carbon footprint is a foundational step towards an effective sustainability management program. Understanding where your company stands in terms of GHG emissions across the three scopes depicted in Figure 7-1 helps identify areas for reduction and informs decision-making on decarbonization strategies. Each scope captures different types of GHG emissions, providing a comprehensive view of your organization's climate impact.

FIGURE 7-1

GHG Protocol Scopes[14]



[14] GHG Protocol: Corporate Value Chain (Scope 3) Accounting and Reporting Standard. Figure 1.1

SCOPE 1

These are direct emissions from sources that are owned or directly controlled by the organization. Examples include emissions from company vehicles or onsite fuel combustion from equipment such as boilers, furnaces, and generators. It also includes process emissions from manufacturing activities and fugitive emissions from refrigeration systems or other equipment leaks.

EXAMPLES

- Company facilities
- Company vehicles

SCOPE 2

These are indirect emissions associated with the generation of electricity, steam, heating, or cooling that a company purchases and consumes. Since manufacturers rely on external energy sources, reducing Scope 2 emissions often involves several strategies. Companies can opt for renewable energy sources, such as solar or wind power, and implement energy efficiency measures by upgrading buildings and processes through on-site renewable energy installations, lighting and window retrofits, and demand response initiatives. Transitioning to renewable energy through PPAs can also significantly lower Scope 2 emissions.

EXAMPLE

- Purchased electricity, steam, heating & cooling for own use

SCOPE 3

Scope 3 emissions include all other indirect emissions that occur in the value or supply chain, both upstream and downstream. As shown in Figure 7-2, Scope 3 emissions are often the largest portion of a company's carbon footprint and can include emissions from suppliers such as raw material production, transportation, emissions from the use and disposal of products by consumers, and business travel and employee commuting. Scope 3 emissions are often the hardest to obtain accurate and consistent data for quantification. Therefore, manufacturers should low significant time for supplier engagement, data collection, calculation and refining results. This process can often take a year or more to adequately quantify.

EXAMPLES

- Purchased goods & services
- Capital goods
- Fuel & energy related activities
- Transportation & distribution
- Business travel
- Waste generated in operations
- Processing of sold products
- Use of sold products
- Employee commuting
- Leased assets
- End-of-life treatment of sold products
- Franchises
- Investments

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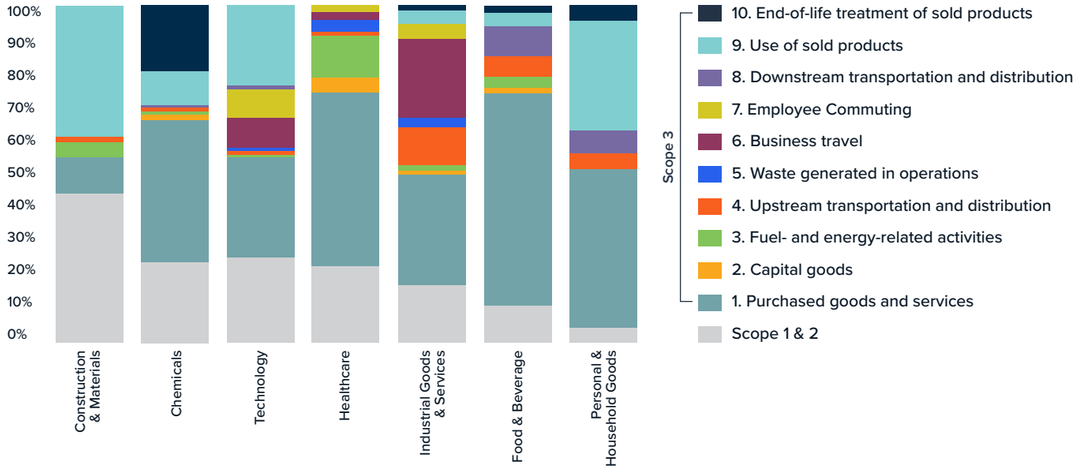
FIGURE 7-2

Scope 3 Emissions by Industry Sector and Category



Source: Quantis

5.1.2 - The GHG Protocol Framework

The GHG Protocol is the leading global standard for calculating and reporting GHG emissions, developed by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD). It provides comprehensive guidance on measuring, managing, and reporting GHG emissions across various sectors and scopes. As the most widely used international framework, the GHG Protocol ensures that companies can consistently track, report, and reduce their emissions across industries and geographies. By adhering to this framework, organizations enhance their credibility in sustainability reporting while ensuring compliance with global regulations and stakeholder expectations. The following are key components of the GHG Protocol:

CORPORATE ACCOUNTING AND REPORTING STANDARD (CARS)

This is a key component of the GHG Protocol, offering guidance to companies on how to calculate and report GHG emissions. By adopting CARS, manufacturers can establish accurate and transparent reporting practices that meet international standards, ensuring reliable emission data that can be compared across industries.

IDENTIFYING SOURCES OF EMISSIONS (SCOPE 1, 2, AND 3)

A critical element of the GHG Protocol is its classification of emissions into three scopes, which allows businesses to systematically track the various sources of their carbon footprint.

5.1.3 - Establishing Baselines and Benchmarks

Establishing baselines and benchmarks is another important step in measuring sustainability performance and setting meaningful goals. By doing so, manufacturers can track their progress over time, identify areas for improvement, and compare their performance with industry peers. These processes provide clear metrics to manage, monitor, and improve sustainability reporting and performance.

5.1.3.1 - Baselines

A baseline represents the starting point or initial measurement of a company's sustainability performance in specific areas, such as GHG emissions, energy consumption, water use, or waste generation. Establishing a baseline is essential for tracking improvements over time and measuring the impact of sustainability initiatives. For manufacturers, developing these baselines is particularly relevant as it allows manufacturers to align with state and federal sustainability regulations and enhance their competitive edge in a rapidly evolving market. Creating a baseline for sustainability metrics involves several key steps to ensure accurate and meaningful progress measurement. First, organizations must conduct thorough data collection, gathering historical and current information on relevant metrics such as energy use, carbon emissions, and water consumption. This process should primarily rely on accurate data from direct operations or suppliers, which is crucial for manufacturers that are striving for efficiency and compliance.

Selecting a baseline year is crucial to providing a stable reference point for future comparisons. The baseline year should reflect normal operations without significant anomalies or disruptions. A clearly defined scope of measurement, or project boundary, is also important—whether it includes Scope 1, 2, and 3 emissions or focuses solely on direct and indirect emissions from specific facilities or global operations. This clarity helps manufacturers to effectively communicate sustainability efforts to stakeholders and regulators. Organizations should also consider external factors that could influence the baseline, such as fluctuations in production volume, changes in weather patterns, or market conditions. Understanding these external factors can lead to more resilient and adaptable operations, ultimately benefiting the bottom line.

ESTABLISHING A BASELINE

1. Conduct thorough data collection, and gather historical and current information on relevant metrics.
2. Select a baseline year to provide a stable reference point.
3. Clearly define the scope of measurement, or project boundary.
4. Consider external factors that could influence the baseline.
5. Regularly review the baseline to allow for adjustments in response to significant changes in business operation.

Finally, regularly reviewing the baseline is essential, allowing for adjustments in response to significant changes in business operations—such as acquisitions or improvements in data accuracy. This ongoing evaluation ensures that the baseline remains relevant and effective in tracking sustainability efforts over time. Maintaining a current and accurate baseline is vital for demonstrating commitment to sustainability and for accessing potential funding opportunities aimed at enhancing green practices in manufacturing.

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5.1.3.2 - Benchmarks

Benchmarks are performance comparisons that help organizations evaluate their sustainability efforts in relation to industry standards, competitors, or global best practices. Benchmarking is particularly relevant as it enables manufacturers to identify strengths, weaknesses, and opportunities for improvement while providing a frame of reference to set achievable and ambitious sustainability targets.

Benchmarking involves several key steps. It is essential to identify relevant benchmarks by selecting the most pertinent industry frameworks and metrics provided by industry associations, regulatory bodies, or sustainability reporting organizations like GRI or SBTi. This allows manufacturers to measure their sustainability performance against criteria specific to their sector. Organizations should then assess how their performance compares to industry averages and leading companies within their sector to determine whether their targets are competitive or need adjustment to stay ahead in an increasingly sustainability-focused market.

Using these benchmarks, companies can set Specific, Measurable, Achievable, Relevant, and Time-bound (SMART) sustainability targets that align with global standards, such as the Paris Agreement and the UNSDGs.
This enhances credibility and facilitates compliance with emerging regulations. Finally, benchmarking presents opportunities for innovation and leadership. By establishing ambitious sustainability goals, such as achieving Zero Waste in manufacturing or transitioning to 100% renewable energy, manufacturers can differentiate themselves in the market and attract customers who prioritize sustainable practices.

ESTABLISHING BENCHMARKS

1. Identify relevant benchmarks by selecting the most pertinent industry frameworks and metrics.
2. Assess how your performance compares to industry averages and leading companies within the sector.
3. Set SMART sustainability targets.
4. Look for opportunities for innovation and leadership.

5.2

Data Collection and Management

Effective data collection and management are vital to advancing sustainability goals.

Accurate data enables organizations to measure their environmental impact, track progress, and make informed decisions, all of which are crucial for improving sustainability performance. Key areas of focus are discussed below.

5.2.1 - Plant & Equipment Data Collection

Sustainability performance hinges on resource efficiency. South Carolina manufacturers can benefit from collecting detailed data across key areas like energy, water, waste, and submetering, which can provide insights into operational efficiency and highlight opportunities for improvement.

Energy	Monitoring real-time energy consumption helps evaluate performance and identify inefficiencies. Usage can be tracked across facilities, equipment, and processes to optimize energy consumption and reduce costs. For instance, installing energy meters on individual machinery can reveal inefficiencies that aggregated monitoring may miss.
Water	Tracking water usage throughout production stages (cooling, sanitation, processing) allows manufacturers to assess water efficiency and manage related risks, such as scarcity or regulatory compliance. Utilizing water meters or flow sensors at critical points can help reduce unnecessary consumption.
Waste	Measuring waste generation (solid, hazardous, and non-hazardous) allows manufacturers to evaluate their waste reduction efforts. Conducting waste audits, implementing reduction initiatives and monitoring results can help minimize landfill waste.
Submetering	Implementing submetering systems enables detailed tracking of resource usage at the equipment or process level, providing manufacturers with granular insights into their consumption patterns.

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5.2.2 - Data Integrity

Accurate and reliable data are crucial for making informed sustainability decisions. Without trustworthy data, organizations risk misrepresenting their performance and missing opportunities for improvement.

PRIMARY VS. SECONDARY DATA

Prioritizing primary data (meter readings, equipment logs) is essential for reliability, while secondary data can supplement it. Transparency in documenting secondary data usage enhances credibility in reporting.

QUANTITATIVE VS. QUALITATIVE DATA

Combining quantitative data (e.g., GHG emissions) with qualitative context offers a comprehensive view of sustainability performance.

5.2.3 - Digital Solutions, Data Warehouses, and Automation

Integrating digital solutions and automation into sustainability management will improve data collection and provide actionable insights into environmental impacts.

Centralized Platforms	Cloud-based data warehouses and ERP systems with sustainability modules enable manufacturers to track essential metrics—energy, water, waste, and emissions—offering a comprehensive view of their environmental footprint. Real-time monitoring helps quickly identify inefficiencies, while automated reporting ensures compliance with regulations like CSRD and other climate disclosure requirements.
Automated Data Collection	Sensors and submeters continuously monitor energy and resource usage, minimizing errors and enabling real-time tracking. This precision is vital for achieving sustainability goals.
Decision-Making	Aggregating data from various sources allows manufacturers to analyze trends and set specific sustainability targets. For instance, manufacturers can use data warehousing to assess energy patterns and evaluate renewable energy options, like solar installations.
Supply Chain Monitoring	Digital solutions help monitor supplier sustainability practices by integrating supplier environmental data to comply with Scope 3 GHG emissions requirements. Continuous tracking enhances supplier relationships and ensures alignment with sustainability goals.

5.2.4 - Verification and Assurance

Verification and assurance are key elements for ensuring the reliability and credibility of sustainability reports and data. As companies work to reduce their environmental impact and align with global sustainability goals, third-party verification and assurance will enhance the trustworthiness of their efforts.

VERIFICATION

Independent verification of emissions and sustainability data ensures the accuracy and transparency of reported information. This process involves a thorough review of GHG emissions, resource usage, and waste management practices. Verified data can be used for regulatory compliance, investor disclosures, and public reporting.

ASSURANCE

Third-party assurance of sustainability reports builds investor and stakeholder confidence. Assurance services validate that sustainability claims, including progress on emissions reduction and resource efficiency, are credible and aligned with established standards such as GRI, SASB, and SBTi.

5.3

Data and Supply Chain Stewardship

Effective management of data and stewardship within the supply chain is important for South Carolina manufacturers aiming to drive sustainability improvements.

This includes implementing clear procurement standards and fostering robust supplier engagement programs.

PROCUREMENT STANDARDS

Sustainability-focused procurement standards help ensure that suppliers meet stringent sustainability requirements. By embedding sustainability criteria into procurement processes, manufacturers can exert significant influence on their suppliers' operations, driving broader adoption of sustainable practices.

SUPPLIER ENGAGEMENT

Engaging suppliers in sustainability efforts is essential for reducing the environmental and social impacts of the supply chain. By fostering partnerships and sharing best practices, manufacturers can encourage suppliers to set and achieve their own sustainability goals. This includes conducting regular assessments, providing resources for improvement, and helping suppliers align with broader corporate sustainability targets.

By focusing on these data collection and management strategies, manufacturers can significantly enhance their sustainability performance, reduce operational costs, and build a more resilient and competitive manufacturing sector. Integrating these practices not only supports compliance with regulations but also fosters innovation and aligns with growing sustainability demands in the market.

Case Studies

#1

Patagonia

Patagonia, a renowned outdoor apparel and gear company, has achieved global recognition as a leader in sustainability. Central to Patagonia's core values, mission, and vision, sustainability shapes its corporate strategy and is integrated into every aspect of its value chain. This unwavering commitment drives the company's success and positions Patagonia as a model for balancing profitability with environmental and social responsibility. By prioritizing the health of the planet while achieving financial success, Patagonia sets a powerful and inspiring example for manufacturers in South Carolina.

Key Initiatives:

Use of Recycled and Sustainable Materials	Patagonia was one of the first companies to use recycled materials in its products–its fleece jackets are made from recycled polyester that was once plastic bottles. The company focuses on sustainable sourcing materials like organic cotton and responsibly sourced wool, minimizing environmental harm while maintaining high product quality.
Worn Wear Program and Product Longevity	One of Patagonia's hallmark initiatives is its "Worn Wear" program, which encourages customers to repair, reuse, and recycle their old gear. The program promotes a circular economy by offering repair services for Patagonia products and reselling secondhand items. This initiative reduces waste and fosters customer loyalty.
Environmental Activism and Corporate Advocacy	Patagonia contributes 1% of its annual sales to the conservation and restoration of the environment through the "1% for the Planet" program. The company is an advocate for environmental action by developing public campaigns, funding grassroots organizations, and participating in legal battles to protect public lands. This engagement has strengthened Patagonia's reputation as a purpose-driven business.
Climate Neutrality Commitment	Patagonia has committed to achieving carbon neutrality by 2025. This involves reducing carbon emissions at every stage of production, from sourcing raw materials to manufacturing and distribution. The company's transparency in reporting its progress toward this goal further demonstrates its leadership in climate action.
Fair Labor Practices	Patagonia is a member of the Fair Labor Association and works to ensure that its employees are treated fairly, with safe working conditions and fair wages. By auditing its supply chain and promoting social responsibility, Patagonia sets a high standard for ethical labor practices.

Impact and Benefits:

Brand Loyalty and Customer Engagement	Patagonia's deep commitment to sustainability has earned it a loyal customer base that identifies with the company's environmental values. The Worn Wear program and its focus on product longevity fosters strong relationships with consumers who appreciate transparency and dedication to sustainability.
Market Differentiation and Investor Confidence	Patagonia has differentiated itself in a crowded marketplace by placing sustainability at the core of its business. This attracts eco-conscious consumers and resonates with investors seeking to support businesses with strong sustainability performance.
Long-Term Resilience	Patagonia's focus on sustainability has resulted in lower exposure to environmental and social risks, contributing to long-term resilience. Its proactive approach to climate change and resource conservation positions Patagonia to thrive in a future where sustainability is increasingly critical to business success.

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#2

Interface

Interface is a commercial flooring company based in Atlanta, GA that has established itself as a leader in sustainability by using Environmental Product Declarations (EPDs) to increase transparency and reduce its environmental impact. EPDs give customers clear, third-party-verified information about the environmental footprint of Interface's products, including carbon emissions, resource use, and waste through a cradle-to-gate life cycle analysis. EPDs are one aspect of Interface's bold "Climate Take Back" mission to reverse global warming and work toward a carbon-negative future. By incorporating EPDs into its product strategy, Interface helps customers achieve green building certifications like LEED and drives meaningful progress in sustainable innovation, especially in the manufacturing industry. This commitment sets a high standard for South Carolina manufacturers balancing profitability with purpose.

Key Initiatives:

EPDs	Interface publishes EPDs for a wide range of products, including carpet tiles and luxury vinyl tiles. These declarations provide a cradle-to-gate life cycle analysis, certified by third-party organizations, offering key metrics such as global warming potential, energy use, and water consumption.
Climate Take Back Mission	Interface has committed to making its operations and products carbon negative by 2040. This mission is guided by science-based goals to reduce GHG emissions and improve resource efficiency across its operations.
LEED Support and Advocacy	Interface's products with EPDs help customers earn LEED credits under the Materials and Resources category. The company actively promotes sustainable building practices and certifications to encourage greener construction.
Circular Economy Practices	Interface has established closed-loop recycling programs that convert old flooring materials into inputs for new products. These initiatives reduce waste and minimize the need for virgin materials, supporting a more sustainable, circular economy.

Impact and Benefits:

Market Leadership in Sustainability	Interface sets a strong example for the flooring and construction industries by demonstrating how transparency and carbon reduction can drive innovation and competitive advantage.
Progress Toward Net-Zero Goals	The company actively aligns with global sustainability frameworks, including the Paris Agreement and the SBTi, advancing its progress toward achieving net-zero emissions.
Carbon Footprint Awareness	Through EPDs, Interface provides customers with actionable insights that enable them to make informed decisions about low-impact flooring solutions.
Increased LEED Certification Potential	Interface's products with EPDs contribute to LEED credits, helping customers achieve green building and sustainability certification goals.
Support for Sustainable Procurement	Interface facilitates compliance with sustainable purchasing policies and supports corporate sustainability commitments by offering transparent and environmentally responsible product options.
Influence on Market Transformation	The company encourages competitors and industry stakeholders to adopt practices like transparency, life-cycle analysis, and circular economy principles, contributing to a broader shift toward sustainability throughout the industry.

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#3

Method Products

The Chicago facility for Method Products, known as the "South Side Soapbox", is a standout example of sustainable manufacturing. With its LEED Platinum certification, the facility combines innovative environmental practices, renewable energy, and a strong focus on community impact. Method has designed the South Side Soapbox to optimize energy efficiency, reduce waste, and streamline operations—all while creating a positive workplace for employees and investing in the local community. It's a powerful example of how manufacturers in South Carolina can balance environmental, social, and economic sustainability.

Key Initiatives:

On-Site Renewable Energy Generation	The facility features one 230-foot wind turbine as well as several 35-foot by 35-foot solar panel arrays. Together the solar panel arrays and wind turbine generate 50% of the South Side Soapbox's energy needs, significantly reducing reliance on external energy sources.
Innovative Green Roof Design	A 75,000-square-foot green roof was constructed to act as a natural insulator, helping to lower the building's energy demand for heating and cooling. The roof also serves as an urban farm, producing 500 tons of fresh produce annually, which is shared with the local community.
Integrated Operations Under One Roof	The facility has combined manufacturing, bottling, and distribution operations into a single building. This consolidation reduces both transportation costs and GHG emissions associated with logistics.
Sustainable Employee-Focused Features	The South Side Soapbox design includes enhanced natural lighting and ventilation in workspaces, creating a more comfortable and productive environment for employees. The parking lot's solar arrays also mitigate the urban heat island effect by providing shade and protection for employee vehicles.
Community Revitalization	The facility is intentionally located in Chicago's Pullman neighborhood, where it provides local employment opportunities and plays a key role in revitalizing the underserved community.

Impact and Benefits:

Energy Efficiency and Emissions Reduction	Renewable energy sources, including the on-site wind turbine and solar panels, meet 50% of the facility's energy demand, reducing reliance on non-renewable energy. Additionally, the integration of manufacturing, bottling, and distribution operations under one roof significantly reduces emissions associated with transportation logistics.
Stormwater Management and Urban Heat Island Mitigation	The factory's green roof plays a critical role in stormwater management by capturing rainwater and preventing urban runoff. Meanwhile, the solar arrays in the parking lot provide shade that reduces localized heat, helping to mitigate the urban heat island effect.
Economic and Social Contributions	The factory supports economic growth by creating jobs in a historically underserved neighborhood. It also contributes to community health and food access by producing and distributing fresh, locally grown food from its green roof.
Industry Leadership in Sustainability	The South Side Soapbox demonstrates the feasibility and benefits of sustainable manufacturing practices. It highlights how renewable energy, and green infrastructure can be effectively scaled in manufacturing settings to drive environmental and operational success.

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#4

Argos

Argos USA LLC, a cement manufacturer with operations across the U.S., operates a plant in Harleyville, South Carolina. This plant was one of 95 manufacturing plants in the U.S. to earn the 2020 ENERGY STAR Certification from U.S. EPA for outstanding energy efficiency. By focusing on energy management and process improvements, Argos USA's Harleyville Plant achieved significant savings and environmental benefits, setting a strong example of sustainability in the cement industry. Through process optimization, the use of alternative fuels, and commitment to continuous improvement, the Harleyville Plant reduced energy costs and contributed to global efforts to reduce GHG emissions. The plant's success offers valuable insights for other manufacturers looking to enhance their sustainability initiatives while driving operational efficiency.

Key Initiatives:

Optimizing Cement Grinding Process	Argos USA improves the efficiency of its cement grinding operations by fine-tuning equipment and processes to optimize energy use and reduce energy consumption while maintaining production levels.
Alternative Fuels	The Harleyville Plant incorporates waste materials from other industrial processes as alternative fuels, which helps it replace traditional, energy-intensive fuels, further lowering the plant's overall energy consumption and reducing environmental impact.
Continuous Process Improvement	Argos USA maintains a focus on continuous improvement by regularly assessing and refining all plant processes to ensure that energy efficiency remains at the forefront of operations. This approach allows for ongoing savings and operational gains.

Impact and Benefits:

Energy Cost Savings	Through its ENERGY STAR Certification and various energy-saving initiatives, the Harleyville Plant achieved significant reductions in energy bills. In 2020, all 95 of the country's ENERGY STAR-certified plants collectively saved nearly $400 million in energy costs. This amount is equivalent to the payroll of over 8,000 U.S. manufacturing jobs.
Energy Consumption Reduction	The Harleyville Plant's efforts were part of a broader collective impact by the country's 95 ENERGY STAR-certified plants, which avoided the consumption of 80 trillion BTUs of energy compared to average plants.
GHG Emission Reductions	By optimizing energy use, the Harleyville Plant helped prevent the release of over 5 million metric tons of GHGs. This is roughly equivalent to the annual energy use of 600,000 homes, contributing significantly to global climate mitigation efforts.
Environmental Benefits	In addition to lowering operational costs, Argos USA's energy efficiency measures helped to reduce the environmental footprint of the Harleyville Plant, reinforcing the company's commitment to sustainability and responsible manufacturing practices.

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#5

Vestas

Vestas, a global leader in wind turbine manufacturing, has set a bold target to produce zero-waste wind turbines by 2040. This goal is a key part of the company's broader sustainability strategy, aimed at reducing its environmental impact and driving circularity within the wind energy sector. To achieve this objective, Vestas is focused on improving supply chain transparency, designing products for easier recycling, and leveraging advanced technologies like digital threads to track and trace materials throughout the manufacturing process. By fostering innovation and efficiency, Vestas is advancing its sustainability goals and enabling customers to configure wind turbines based on their specific carbon footprint goals. The company's zero-waste wind turbine initiative represents a holistic approach to sustainability, innovation, and operational efficiency. Through the use of digital threads, a centralized materials database, and circular product design, Vestas is reducing its environmental footprint while setting new industry standards for sustainable manufacturing and product lifecycle management in the wind energy sector.

Key Initiatives:

Zero-Waste Manufacturing Goal	Vestas has committed to producing wind turbines that result in zero waste by 2040, ensuring the entire lifecycle of the turbine—from manufacturing to decommissioning—is sustainable and circular.
Digital Thread for Supply Chain Transparency	Vestas uses digital threads to connect and enhance the traceability of materials across its supply chain. This digital framework allows for seamless communication between systems, improving transparency and data accessibility at every stage of production.
Centralized Materials Database	The company has implemented a centralized materials database, which allows engineering teams to make data-driven decisions on material selection for design. This ensures that only sustainable and recyclable materials are used.
Product Design for Circularity	Vestas is redesigning wind turbines to ensure they are easier to recycle or reuse at the end of their life cycle. Key design changes include using thermoplastic resins instead of thermoset materials, which facilitates recycling.
Carbon Footprint Tracking and Customer Configuration	Through the digital thread, Vestas enables customers to configure their wind turbines based on carbon footprint considerations, offering insights into the environmental impact of various materials and designs.
Innovation and Efficiency Gains	The use of real-time data and digital tools helps Vestas drive innovation in turbine manufacturing. The company continuously identifies ways to optimize processes, reduce energy consumption, and minimize waste throughout production.

Impact and Benefits:

Sustainability and Circular Economy Leadership	Vestas is positioning itself as a market leader in sustainability within the wind energy sector. Its commitment to zero-waste manufacturing helps drive the global transition to renewable energy and contributes significantly to reducing the environmental footprint of wind energy production.
Improved Operational Efficiency	By integrating digital tools and enhancing supply chain traceability, Vestas has achieved operational efficiencies which reduce waste, energy consumption, and overall production costs, improving both the economic and environmental sustainability of its operations.
Enhanced Product Lifecycle Management	Vestas' focus on product design for circularity means that its wind turbines will be easier to recycle or repurpose at the end of their operational life. This reduces the environmental impact and helps close the loop in the wind turbine manufacturing process.
Customer-Centric Carbon Footprint Insights	The ability for customers to configure turbines based on carbon footprint considerations empowers them to make more sustainable choices. This enhances Vestas' value proposition and helps clients meet their own sustainability targets, making Vestas a preferred partner in the clean energy sector.
Innovation-Driven Growth	By optimizing service and manufacturing processes, Vestas solidifies its position as an industry leader, while contributing to the long-term scalability of the wind energy market. Through continuous innovation in manufacturing processes and design, Vestas is improving its competitive edge.

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#6

BMW Manufacturing Co.

BMW Manufacturing Co. (BMW) in Spartanburg, South Carolina, has established itself as a global leader in sustainable automotive manufacturing. Since opening in 1994, the facility has grown into the largest BMW production site worldwide producing BMW's X models and employing more than 11,000 people. Known for its commitment to sustainability, innovation, and community involvement, BMW Manufacturing has implemented a broad range of practices focused on reducing environmental impact and increased social responsibility. Through a combination of cutting-edge manufacturing techniques, resource conservation initiatives, employee engagement, and active community support, BMW Manufacturing has set a high standard for sustainability in the automotive industry. These efforts reinforce BMW's leadership in sustainable manufacturing and contribute to a more sustainable future for the entire automotive industry and the communities it serves.

Key Initiatives:

CO_2 Neutrality in Production	BMW aims to achieve climate neutrality across its value chain by 2050, with interim science-based targets aligned with the SBTi. The Spartanburg plant plays a key role in this strategy by integrating CO_2-reducing measures, including energy efficiency upgrades, green logistics, and low-carbon materials like recycled aluminum and green steel.
100% Renewable Energy Supply	The Spartanburg facility operates 100% on electricity from renewable sources. For over 20 years, it has utilized recycled methane gas from a nearby landfill to generate electricity and hot water. A significant portion of its energy comes from an innovative landfill gas-to-energy project, which is further supplemented by on-site solar installations. Instead of flaring the methane gas, BMW captures it using dozens of extraction wells at the landfill. The gas is then treated to remove moisture and impurities, compressed at the landfill's Recovery and Compression Station, and transported through a 9.5-mile pipeline to the Spartanburg facility.
Water Management and Conservation	BMW has implemented advanced water recycling systems and rainwater harvesting technologies that have significantly reduced freshwater consumption. As of 2023, BMW has cut water usage per vehicle produced by over 20% globally since 2006, with Spartanburg contributing through ongoing innovation in water reuse and treatment.
Lean Manufacturing and Waste Reduction	Lean manufacturing principles are core to Spartanburg's operations. The facility diverts more than 95% of its waste from landfill and continues to reduce energy and material usage per vehicle through digitalized, data-driven process optimization.
Circular Economy Integration	BMW applies circular economy principles by increasing the use of secondary (recycled) raw materials in its manufacturing processes. This includes high proportions of recycled plastics, aluminum, and steel in vehicle components. By adopting a closed-loop approach, BMW reduces reliance on virgin raw materials, lowers environmental impacts, and enhances supply chain resilience.
Employee Engagement and Training	BMW fosters a culture of sustainability by investing in continuous employee training and encouraging staff to contribute ideas for environmental improvements. Through its "Green Ideas" program, employees are empowered to propose and implement sustainable initiatives. In 2023 alone, more than 5,000 suggestions were submitted globally—many of which came from U.S.-based team members. This approach not only promotes innovation but also increases employee engagement in the company's sustainability goals.
Community Engagement and Philanthropy	BMW partners with regional schools, colleges, and workforce programs to promote STEM education and technical careers. The BMW Scholars Program offers apprenticeships and tuition assistance, helping to build a skilled, sustainability-minded workforce in South Carolina.
Annual Sustainability Reporting	BMW maintains transparency by publishing detailed annual sustainability and integrated reports that align with global standards such as the Global Reporting Initiative (GRI), Sustainability Accounting Standards Board (SASB), and the European Sustainability Reporting Standards (ESRS). These reports offer insights into BMW's environmental performance, supply chain due diligence, climate targets, biodiversity efforts, and broader social responsibility initiatives.

Impact and Benefits:

Significant Carbon Emissions Reduction	By operating on 100% renewable energy and achieving CO_2 neutrality in production, BMW has significantly reduced its carbon emissions, supporting global climate goals. The Spartanburg facility, through its use of 100% renewable energy and sustainable materials, has contributed to BMW's group-wide reduction of CO_2 emissions per vehicle.
Water Conservation	Advanced water management practices at Spartanburg have reduced water consumption, helping to preserve local water resources and minimize environmental impact. The facility's water management strategy decreases reliance on municipal water supplies and protects regional ecosystems.

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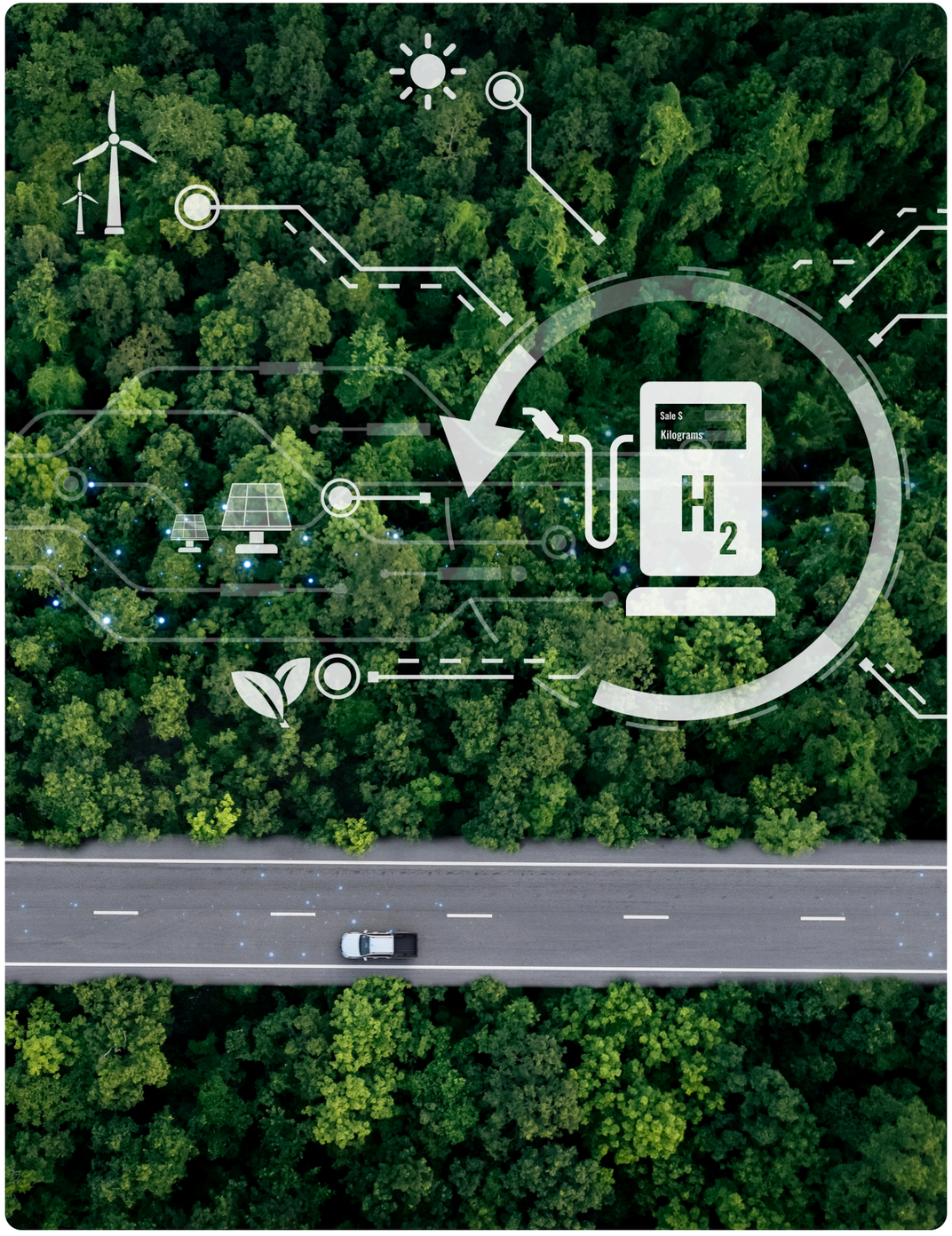
Economic Growth & Job Creation	BMW Manufacturing has created thousands of jobs and contributes billions to the South Carolina economy. Its emphasis on local sourcing and talent development strengthens regional resilience.
Empowered Workforce	Employee engagement programs lead to higher satisfaction, increased innovation, and better environmental performance, reinforcing a culture of continuous improvement.
Positive Community Impact	Through philanthropic efforts and partnerships with environmental and educational organizations, BMW helps improve community well-being, access to education, and local conservation efforts.
Recognized Sustainability Leadership	BMW has received multiple awards for environmental performance, energy efficiency, and corporate responsibility, including ENERGY STAR certifications and recognition from the U.S. EPA.
Operational Excellence & Efficiency	Efficiency gains through digitalization, lean practices, and predictive maintenance have improved both sustainability outcomes and business performance.



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BMW Group Sustainability Goals

BMW Spartanburg Corporate Sustainability

ASCM – Principles of Lean Manufacturing

#7

Sage Automotive Interiors

Sage Automotive Interiors (Sage), headquartered in South Carolina, is a recognized manufacturing leader in the automotive interior products industry. Known for its commitment to sustainability and cutting-edge manufacturing processes, the company has woven environmental responsibility into the fabric of its operations. From energy efficiency initiatives to waste reduction strategies and the development of sustainable products, Sage's approach sets a high bar for sustainability within the automotive sector. Sage is a prime example of how effective corporate policy development can drive both environmental impact and business success for manufacturers in South Carolina. Through strategic actions in energy efficiency, waste reduction, and the creation of sustainable products, the company has achieved measurable benefits for the environment, cost savings, and enhanced market competitiveness. As Sage continues to innovate and expand its sustainability practices, it is poised for long-term success in an increasingly environmentally-conscious market landscape.

Key Initiatives:

Environmental Policy and Standards Compliance	Sage has implemented a robust Environmental Policy, adhering to ISO 14001 Environmental Management Standards, the Registration, Evaluation, Authorization, and Restriction of Chemicals (REACH), and the Restriction of Hazardous Substances (RoHS) regulations. This policy drives sustainable operations and ensures compliance with global environmental regulations.
Sustainable Sourcing	The company has developed a comprehensive sourcing policy that focuses on procuring materials from sustainable suppliers. It emphasizes reducing environmental impact throughout the supply chain and sourcing raw materials responsibly.
Energy Efficiency and Carbon Footprint Reduction	Sage has made significant progress in reducing energy consumption in its manufacturing facilities. The company invests in energy-efficient technologies such as LED lighting and advanced heating systems to lower carbon emissions and operational costs.
Governance and Transparency	Sustainability is overseen at the board level, with transparent annual reporting on environmental goals and progress. The company adheres to global reporting standards, such as the GRI, to maintain accountability.
Stakeholder Engagement and Employee Training	Sage engages with employees, customers, and the local community through ongoing sustainability education initiatives and open communication. Training programs are in place to ensure that sustainability is embedded at all levels of the organization.
Waste and Circular Economy Initiatives	Sage promotes circular economy principles through waste reduction programs, product design for disassembly, and material recycling. The company's facilities are striving for zero-waste operations, minimizing landfill contributions, and increasing material reuse.

Impact and Benefits:

Environmental Impact Reduction	Sage has achieved a significant reduction in GHG emissions through the adoption of energy-efficient technologies and renewable energy investments. This has allowed the company to meet or exceed industry standards for emissions reduction.
Waste Reduction	Sage's circular economy initiatives have resulted in a substantial decrease in waste sent to landfills. Through their zero-waste programs, the company has diverted large volumes of material for recycling and reuse.
Cost Savings	Energy efficiency initiatives have not only reduced Sage's carbon footprint but also led to operational cost savings. The company has lowered its energy bills and reduced waste disposal costs by investing in more sustainable practices.
Product Innovation	Sage's commitment to sustainability has spurred the development of innovative, sustainable products, such as fully recyclable interior materials. These products meet the increasing demand from automakers for sustainable materials, enhancing Sage's competitive advantage in the market.
Industry Recognition	Sage has been recognized with multiple industry awards, including ENERGY STAR Certification and the Sustainability Leadership Award, affirming the company's leadership in sustainability and its positive impact on the industry.
Stakeholder Trust and Reputation	By maintaining transparent communication and demonstrating measurable progress towards sustainability goals, Sage has built strong relationships with stakeholders, including customers, employees, and regulators. This trust enhances the company's reputation and strengthens its position as a responsible corporation.
Future Growth Opportunities	Sage's ongoing sustainability efforts have paved the way for future growth opportunities, including meeting increasing demand for sustainable products, entering new markets, and aligning with global sustainability trends.

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#8

Rolls Royce

The Rolls-Royce Facility in Aiken, South Carolina is an example of how manufacturers in South Carolina can embrace clean energy technologies, reduce emissions, and improve operational efficiency. The facility has built a solar-powered microgrid that integrates clean energy generation, energy storage, and backup power.

Key Initiatives:

Microgrid Installation	The microgrid consists of a 1.0 MW ground-mount solar array and a 0.75 MW parking lot-cover solar array supported by a 1 MWh Battery Energy Storage System (BESS) and a 300 kW diesel generator.
Reduced Energy Demand	The microgrid stores energy generated during the day to power operations at night, reducing reliance on grid electricity and enhancing overall energy efficiency. By shaving peak demand during high-use periods, it further minimizes dependence on the grid.
Energy Optimization	The microgrid ensures that essential parts of the facility, such as the Administration and R&D buildings, stay up and running even during grid disruptions.
Community and Grid Support	In the event of a grid outage, the microgrid can also provide power to a portion of the surrounding community.

Impact and Benefits:

Environmental Benefits	The microgrid avoids approximately 770 metric tons of CO_2 emissions per year and generates over 1 million kWh of clean energy annually.
Operational Benefits	The microgrid ensures uninterrupted power for essential areas, such as the Administration and R&D Buildings, while contributing to energy independence with self-generated renewable power. The system also bolsters resilience to grid outages, supporting consistent operations.
Economic Benefits	The microgrid delivers long-term cost savings by reducing reliance on grid power and managing peak demand efficiently. The project was self-funded, with savings generated through energy cost reductions and operational efficiency.
Community Impact	By potentially providing power parts of the local town during outages, the facility enhances grid resilience. It also sets a strong example of how industrial operations can integrate renewable energy and achieve sustainability goals while also benefiting the communities in which they are located.

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#9

Velux

VELUX Greenwood, part of the global VELUX Group, is a South Carolina-based manufacturer of skylights and roof windows with a strong commitment to sustainability. The company has set ambitious goals to achieve carbon neutrality and address its historical environmental impact through a comprehensive sustainability plan. This plan emphasizes waste reduction, energy efficiency, and resource recovery, while also advancing broader initiatives such as forest conservation and renewable energy adoption. By embracing innovative practices and collaborating with local partners, VELUX Greenwood has positioned itself as a leader in sustainable manufacturing. This holistic approach highlights VELUX's dedication to environmental responsibility and serves as a practical model for other manufacturers looking to reduce their environmental footprint.

Key Initiatives:

Waste Stream Reduction and Recycling Partnerships	VELUX collaborates with the South Carolina Department of Commerce in OpExChange matchmaker events to identify local recycling partners to reduce waste sent to landfill.
Circular Economy Practices	The company emphasizes recycling and reusing materials in production, reducing demand for virgin materials and aligning with circular economy principles.
Life Cycle Assessments (LCAs)	VELUX uses LCAs to evaluate and reduce the environmental footprint of products, targeting areas such as material sourcing and production efficiency.
Material Reuse	Recycled materials are integrated into manufacturing cycles, lowering resource demands and waste.
Reforestation Projects	VELUX supports global reforestation initiatives to offset carbon emissions and resatore ecosystems.
Biodiversity Protection	The company invests in projects to preserve local ecosystems and promote climate resilience.
Solar Power Expansion	Increased use of solar energy has reduced GHG emissions from operations.
Energy Optimization	By adopting energy-efficient technologies, production resource intensity has been reduced.

Impact and Benefits:

Landfill Diversion	VELUX has achieved a significant reduction in waste sent to landfills through partnerships with local recyclers.
Reduced Carbon Footprint	The use of renewable energy and reduction of waste streams has decreased GHG emissions.
Investments in Biodiversity	VELUX demonstrates its commitment to long-term environmental sustainability through strategic investments in biodiversity, particularly reforestation and ecosystem restoration projects. These initiatives aim to combat deforestation, enhance carbon sequestration, and support the recovery of natural habitats.
Cost Savings	VELUX has reduced its waste management costs through recycling and material reuse strategies.
Resource Efficiency	Improved production processes reduce the need for raw materials, increasing operational sustainability.
Model for Sustainability	VELUX demonstrates how manufacturers in South Carolina can align operational efficiency with environmental responsibility.
Collaborative Success	VELUX showcases the value of partnerships with local stakeholders and government initiatives.

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#10

Milliken & Company

Milliken & Company (Milliken), based in Spartanburg, SC, is a global leader in specialty chemicals, flooring textiles, and healthcare. By integrating innovation, continuous improvement, and elevating sustainability as a core value, Milliken has established itself as a leader in sustainability in South Carolina's manufacturing sector. Its waste management initiatives provide an example of how manufacturers can significantly reduce their environmental impact through simple, scalable solutions. Milliken's approach offers a replicable framework for other manufacturers aiming to reach similar waste reduction goals. The company's strategy reduces its environmental footprint and delivers operational and financial benefits. Through innovative material use, strategic partnerships, and active employee engagement, Milliken sets an industry-leading example in waste reduction. These efforts contribute to a more sustainable future while providing a model for other manufacturers pursuing waste management goals.

Key Initiatives:

Product Design for Minimal Waste	Milliken has begun to design products that generate less waste during production and can be fully recycled at the end of their life cycle. For example, their carpet tiles are made with minimal offcuts and are fully recyclable.
R&D Investment	Milliken has invested heavily in the research and development of processes and products that are both efficient and reduce waste, improving sustainability across the product lifecycle.
Textile Operations	The Company has implemented a closed-loop recycling system in its flooring division where waste from one process is repurposed as input material for another. Fabric scraps, for example, are shredded and used in new products, reducing waste and conserving resources.
Take-Back Programs	They introduced programs allowing customers to return used flooring products to be repurposed or recycled, helping close the loop and extend the lifecycle of materials.
Local Recycling and Waste Management Partnerships	Milliken actively collaborates with local recyclers and waste management companies to create innovative solutions for minimizing waste and enhancing circularity in its operations.
Supplier Engagement	For some products, the company has started working with its suppliers to ensure the materials entering its facilities are designed with reuse and recycling in mind, supporting its overall waste reduction goals.
Cultural Shift Toward Sustainability	Milliken engages employees at all levels to foster a culture of sustainability. Training programs on waste reduction strategies are provided, and employees are encouraged to innovate in their areas of responsibility.

Impact and Benefits:

Resource Conservation	The company's use of recyclable materials helps conserve raw materials and reduce the need for virgin resources.
Lower GHG Emissions	By diverting waste from landfills and recycling materials, Milliken has reduced its carbon footprint and contributed towards progress to cut global emissions.
Cost Savings	Through reduced waste disposal fees and increased material efficiency, Milliken has realized cost savings while reducing the need for virgin materials.
Improved Process Efficiency	Milliken's focus on minimizing waste and improving recycling has streamlined production processes, making them more efficient and less wasteful.
Employee Empowerment	Milliken's employee engagement initiatives have fostered a culture of sustainability, with employees actively contributing to waste reduction efforts and driving innovation within the company.

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#11

Walmart

Walmart, a global retail giant, has launched an ambitious sustainability initiative called Project Gigaton, with the goal of reducing one billion metric tons (a gigaton) of GHG emissions from its supply chain by 2030. Because Scope 3 emissions—the largest portion of its carbon footprint—are the most difficult to manage, Walmart has crafted a strategy that emphasizes supplier engagement, renewable energy, and sustainable agriculture. Through these efforts, Walmart has made significant strides in cutting emissions, demonstrating the power of collaboration and innovation in achieving meaningful sustainability goals.

Key Initiatives:

Supplier Engagement	Walmart works closely with its suppliers to reduce emissions from product manufacturing, transportation, and packaging. The company provides suppliers with tools, resources, and support to help them implement sustainable practices, including digital solutions for tracking and streamlining emissions data.
Renewable Energy Commitment	Walmart has committed to sourcing 100% renewable energy for its global operations by 2035. Several facilities have already transitioned to renewable energy, leading to reduced Scope 2 emissions from electricity consumption.
Sustainable Agriculture	Walmart collaborates with agricultural suppliers to implement climate-smart agricultural practices aimed at reducing emissions from food production. Examples of sustainable agriculture practices include optimized irrigation, sustainable land management, and alternative fertilizers with lower GHG emissions.

Impact and Benefits:

Emission Reductions	By 2020 Walmart successfully CO_2 emissions from its supply chain by over 230 million metric tons, demonstrating the efficacy of its initiatives and collaborative efforts. These reductions were a direct result of Walmart's efforts to engage suppliers, transition to renewable energy, and encourage sustainable agricultural practices.
Collaboration and Innovation	Walmart's focus on collaboration with suppliers has been key to addressing Scope 3 emissions, which are typically outside of a company's direct control. By providing tools for measuring and reducing emissions, Walmart has created a pathway for its suppliers to adopt more sustainable practices. Advanced emissions tracking software and data analytics tools allow Walmart to monitor its progress, track emissions reductions, and identify additional opportunities for improvement.
Strategic Goals and Lessons	The company's clear, measurable target of reducing one gigaton of CO_2 by 2030 has provided a strong incentive for action and a framework for tracking progress. Walmart's success demonstrates the value of setting ambitious targets, collaborating with stakeholders, and leveraging technology to drive systemic change in emissions reduction.

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#12

Nike

The global footwear and apparel company Nike's Supplier Engagement Program is an ambitious initiative designed to drive sustainability and improve labor practices across its global supply chain. By leveraging a structured, multi-tiered approach, Nike works with suppliers to reduce environmental impact, improve worker conditions, and promote ethical practices. The company has integrated sustainability into its core business model, fostering collaboration and continuous improvement with its partners. The Supplier Engagement Program serves as a prime example for manufacturers, particularly in South Carolina, looking to adopt best practices for sustainability and ethical sourcing.

Key Initiatives:

Sustainability Audits	Nike conducts comprehensive audits of suppliers to ensure compliance with environmental and labor standards. Key areas assessed include water usage, waste reduction, and GHG emissions.
Water Usage	Nike encourages the adoption of water-efficient technologies such as working to reduce the water used to dye and finish textiles.
Waste Reduction	Helping suppliers minimize waste and adopt circular economy principles is a key initiative for the brand.
GHG Emissions	Nike monitors and works with suppliers to reduce their carbon footprints, aligning with global frameworks like GRI and SBTi.
Collaborative Partnerships	Nike partners with suppliers to improve sustainability through initiatives like the Move to Zero campaign, which focuses on reducing carbon emissions and waste. Key activities include cleaner technologies, circular economy initiatives, and carbon reduction.
Cleaner Technologies	Nike is working to transition to renewable energy sources (e.g., solar, biomass) and sustainable materials.
Circular Economy Initiatives	Nike promotes product designs that reduce environmental impact through recyclability and repairability.
Carbon Reduction Goals	Nike aims to reduce emissions by 70% by 2025 from a 2015 baseline.
Capacity Building	Nike's Sustainable Manufacturing and Sourcing Index (SMSI) helps suppliers improve their sustainability performance across various domains through training, resources, incentives, and support.
Training and Resources	Nike provides its suppliers with guidance on energy efficiency, safer working conditions, and cleaner production technologies.
Incentives and Support	Nike offers financial incentives and technical assistance to suppliers transitioning to renewable energy sources, particularly in Southeast Asia.

Impact and Benefits:

GHG Emissions Reduction	Nike has reduced its supply chain emissions by 35% since 2015, contributing to its goal of achieving carbon neutrality by 2050.
Water Usage	The company has successfully reduced water consumption by 30% through supplier partnerships focused on water-efficient technologies.
Waste Reduction	Nike has been actively involved in helping suppliers reduce waste and adopt circular economy practices, resulting in a more sustainable manufacturing process.
Improved Labor Conditions	Nike has worked to improve working conditions for hundreds of thousands of workers across its supply chain. The company ensures fair wages, improved safety, and better working environments across its suppliers' facilities.
Ethical Sourcing	Nike's focus on labor standards has raised the bar for ethical sourcing, ensuring that suppliers meet fair and humane working conditions, which aligns with Nike's broader social responsibility goals.

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Long-Term Supplier Relationships	Suppliers who perform well under Nike's SMSI are rewarded with longer-term contracts and additional business opportunities, providing a strong incentive for continuous sustainability improvements.
Leadership in Sustainability	Nike's commitment to sustainability has positioned the company as a leader in responsible manufacturing, demonstrating that environmental and social stewardship can drive business growth and brand loyalty.
Operational Efficiency	As suppliers adopt more energy-efficient technologies and improve waste management, Nike benefits from reduced operational costs and enhanced supply chain resilience.

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Appendix

Acronyms and Abbreviations

ALL4	ALL4 LLC
ASHRAE	The American Society of Heating, Refrigerating and Air-Conditioning Engineers
AIAG	Automotive Industry Action Group
BMW	BMW Manufacturing Co.
BTUs	British Thermal Units
CEQA	California Environmental Quality Act
CBAM	Carbon Border Adjustment Mechanism
CDP	Carbon Disclosure Project
CARS	Corporate Accounting and Reporting Standard
CSRD	Corporate Sustainability Reporting Directive
DJSI	Dow Jones Sustainability Index
ERM	Enterprise Risk Management
EPDs	Environmental Product Declarations
ESG	Environmental, Social, and Governance
ESRS	European Sustainability Reporting Standards
EU	European Union
CSRD	EU's Corporate Sustainability Reporting Directive
GPI	General Program Instructions
GEPA	Georgia Environmental Policy Act
GHG	Greenhouse Gas
GHGRP	Greenhouse Gas Reporting Program
GERSB	Global Real Estate Sustainability Benchmark
GRI	Global Reporting Initiative
IPO	Initial Public Offering
IES	International EPD System
IFRS	International Financial Reporting Standards
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
ISSB	International Sustainability Standards Board
LEED	Leadership in Energy and Environmental Design
LCAs	Life Cycle Assessments
LLPs	Limited Liability Partnerships
MEP	Manufacturing Extension Partnership
MEPA	Minnesota Environmental Policy Act
NDCs	Nationally Determined Contributions
SEQRA	New York State Environmental Quality Review Act
PPAs	Power Purchase Agreements
PCR	Product Category Rule
R&D	Research and Development
Sage	Sage Automotive Interiors
SBTi	Science Based Targets initiative
STEM	Science, Technology, Engineering, and Mathematics
SEC	Securities and Exchange Commission
SMEs	Small and Medium-sized Enterprises
SCMEP	South Carolina Manufacturing Extension Partnership
SMART	Specific, Measurable, Achievable, Relevant, and Time-bound
SEPA	State Environmental Policy Act
SASB	Sustainability Accounting Standards Board
SRG	Sustainability Resource Guide
SMSI	Sustainable Manufacturing and Sourcing Index
TCFD	Task Force on Climate-related Financial Disclosures
UNSDGs	United Nations Sustainable Development Goals
DOE	United States Department of Energy
U.S. EPA	United States Environmental Protection Agency
GHG MRR	U.S. EPA's Greenhouse Gas Mandatory Reporting Rule
USGBC	United States Green Build Council
WBCSD	World Business Council for Sustainable Development
WRI	World Resources Institute

CHEMICAL COMPOUNDS	
CO_2	Carbon dioxide
CO2e	CO_2 equivalents
HFCs	Hydrofluorocarbons
CH_4	Methane
N_2O	Nitrous oxide
PFCs	Perfluorocarbons

Glossary

TERM	ABBREVIATION	DEFINITION
American Society of Heating, Refrigerating and Air Conditioning Engineer	ASHRAE	A global society advancing human well-being through sustainable technology for the built environment, focusing on building systems, energy efficiency, indoor air quality, refrigeration, and sustainability. Please see Pillar 3: Energy Optimization.
Carbon Disclosure Project	CDP	An international non-profit organization that helps companies, cities, states, and regions disclose their environmental impact and provides a sustainability rating for entities.
Carbon Footprint		The total amount of greenhouse gases emitted directly or indirectly by an individual, organization, event, or product.
Circularity		An economic system aimed at eliminating waste and the continual consumption of resources through principles of reuse, repair, refurbishment, and recycling. Please see Pillar 4: Waste Stream Reduction.
Digital Threads		An integrated data framework that connects information across the entire lifecycle of a product, enabling seamless data flow and real-time insights for improved decision-making and efficiency. Please see Pillar 1: Design for Sustainability.
EcoVadis		A provider of business sustainability ratings, evaluating companies' environmental, social, and ethical performance compared to other companies in the industry. Please see Pillar 5: Data and Supply Chain.
Energy Audits		Inspections and analyses of energy flows in buildings or systems to identify opportunities for reducing energy consumption and improving efficiency. Please see Pillar 3: Energy Optimization.
Energy Star		A program that certifies products, buildings, and industrial facilities for superior energy efficiency, helping to reduce energy consumption and environmental impact. Please see Pillar 1: Design for Sustainability.
Environmental Product Declaration	EPD	A standardized document that provides transparent, verified information about the environmental impact of a product throughout its lifecycle. Please see Pillar 1: Design for Sustainability.
Environmental Social Governance	ESG	Please see the Introduction for a complete description of ESG
EU Corporate Sustainability Reporting Directive	CDSRD	EU legislation requiring large companies and listed SMEs to disclose information on their social and environmental impacts. Please see Pillar 5: Data and Supply Chain.
E-Waste		Discarded electrical or electronic devices, often containing hazardous materials, that require specialized handling and recycling processes. Please see Pillar 4: Waste Stream Reduction.
Extended Product Responsibility	EPR	A policy approach where producers are given significant responsibility—financial and/or physical—for the treatment or disposal of post-consumer products. Please see Pillar 4: Waste Stream Reduction.
Financial Stability Board	FSB	An international body that monitors and makes recommendations about the global financial system to promote international financial stability. Please see Pillar 3: Energy Optimization.
Global Real Estate Sustainability Benchmark	GRESB	An international organization that provides sustainability performance data and benchmarks for real estate and infrastructure investments. Please see Pillar 5: Data and Supply Chain.
Global Reporting Initiative	GRI	An international independent standards organization that helps businesses and other organizations understand and communicate their impacts on issues such as climate change, human rights, and corruption. Please see Pillar 5: Data and Supply Chain.
Greenhouse Gas	GHG	A gas that traps heat in the atmosphere, contributing to the greenhouse effect, such as carbon dioxide, methane, nitrous oxide.

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International Sustainability Standards Board	ISSB	A standard-setting body under the IFRS Foundation, created to develop comprehensive global standards for sustainability-related financial disclosures. Please see Pillar 3: Energy Optimization.
LEED Certification		A certification standard for measuring a building's sustainability and environmental performance, awarded based on criteria such as energy efficiency, water conservation, and indoor environmental quality. Please see Pillar 1: Design for Sustainability.
Life Cycle Assessment	LCA	A process to quantify the entire environmental footprint of a product throughout its entire life cycle (raw material extraction to disposal). Please see Pillar 1: Design for Sustainability.
Overall Equipment Efficiency	OEE	A metric used to measure the efficiency and effectiveness of manufacturing equipment, calculated by combining its availability, performance, and quality rates. Please see Pillar 4: Waste Stream Reduction.
Scientific Based Targets Imitative	SBTi	A collaboration that helps companies set greenhouse gas reduction targets in line with climate science and the goals of the Paris Agreement.
Sustainable Accounting Standards Board	SASB	A nonprofit organization that develops industry-specific standards for companies to disclose financially material sustainability information. Please see Pillar 5: Data and Supply Chain.
Sustainable Manufacturing and Sourcing Index	SMSI	A tool used to assess the sustainability performance of manufacturing and sourcing practices within a company. Please see Pillar 5: Data and Supply Chain.
Task Force on Climate-related Financial Disclosure	TCFD	An organization established by the Financial Stability Board to develop voluntary, consistent climate-related financial risk disclosures for use by companies in providing information to investors. Please see Pillar 3: Energy Optimization.
UN Sustainable Development Goals	UNSDG	A set of 17 global goals established by the United Nations in 2015 to address global challenges and achieve a better and more sustainable future by 2030. Please see Pillar 5: Data and Supply Chain.
Zero Waste		A philosophy and design principle for the management of resources that aims to eliminate waste by ensuring that all products are reused, repaired, or recycled back into nature or the marketplace. Please see Pillar 4: Waste Stream Reduction.

About the Author

The written content of this guide was developed by ALL4 LLC. ALL4 is a globally recognized consulting company shaping EHS and Sustainability responsibility and creating distinction for employees, clients, and partners. At ALL4, we believe that a sustainable future is not just a possibility but a responsibility. We live our purpose to "grow sustainable community" every day. We have developed and supported our clients' sustainability efforts for decades and, while we have won awards for our own sustainability efforts in the past, we embarked on a journey in 2021 to formalize our sustainability journey going forward. Internally, we provide personal and professional growth opportunities for our team. Externally, we support the growth of our clients' operations and the communities where they reside. We believe that growth builds community, and community creates the opportunity and responsibility to best nurture our natural resources.

Useful Resources

SECTION / TERM	RESOURCE DESCRIPTION	LINK
Five Pillars	United States Green Building Council's (USGBC)	https://www.usgbc.org/
Five Pillars	International Well Building Institute	https://www.wellcertified.com/
Five Pillars	U.S DOE's ENERGY STAR	https://www.energystar.gov/
Five Pillars	GHG Protocol	https://ghgprotocol.org/
Five Pillars	CDP (formerly Carbon Disclosure Project)	https://www.cdp.net/en
Five Pillars	Fraunhofer USA Sustainability	https://www.fraunhofer.org/en/Research/Competences/Sustainability.html
Benefits of Sustainability	California's Climate Corporate Data Accountability Act (SB 253)	https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=202320240SB253
How to Get Started	SCMEP Sustainability Assessment Survey	https://scmep.org/training-professional-development/assessments/sustainability/
Harnessing Sustainability	South Carolina Energy Office	https://energy.sc.gov/
Harnessing Sustainability	U.S. DOE Better Plants Program	https://betterbuildingssolutioncenter.energy.gov/better-plants
Greenhouse Gas Emissions Management	U.N. Intergovernmental Panel on Climate Change (IPCC)	https://www.ipcc.ch/
Greenhouse Gas Emissions Management	The United Nations Paris Agreement	https://unfccc.int/process-and-meetings/the-paris-agreement
Risks and Opportunities	European Union's Corporate Sustainability Reporting Directive (CSRD)	https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32022L2464
Public Disclosure	Global Reporting Initiative	https://www.globalreporting.org/
Public Disclosure	International Sustainability Standards Board (ISSB)	https://www.ifrs.org/groups/international-sustainability-standards-board/
Public Disclosure	Task Force on Climate-related Financial Disclosures (TCFD)	https://www.fsb-tcfd.org/
1.1.1	ISO 14040:2006	https://www.iso.org/standard/37456.html
1.1.1	ISO 14044:2006	https://www.iso.org/standard/38498.html
1.1.1	Carbon Border Adjustment Mechanism (CBAM)	https://taxation-customs.ec.europa.eu/carbon-border-adjustment-mechanism_en
1.1.2	International EPD System	https://www.environdec.com/home
1.1.2	ISO 14025:2006	https://www.iso.org/standard/38131.html
1.2.1	LEED (Leadership in Energy and Environmental Design)	https://www.usgbc.org/leed
1.4	Sphera - LCA Software	https://sphera.com/solutions/product-stewardship/life-cycle-assessment-software-and-data/
1.4	OpenLCA - LCA Software	https://www.openlca.org/
1.4	SimaPro - LCA Software	https://simapro.com/
1.4	MatWeb – Material Selection Tool	https://www.matweb.com/
1.4	DOE EnergyPlus Energy Efficiency Tool	https://www.energy.gov/eere/buildings/articles/energyplus
1.4	DOE eQUEST – Energy Simulation Tool	https://doe2.com/equest/index.html
1.4	EPA Simplified GHG Emissions Calculator	https://www.epa.gov/climateleadership/simplified-ghg-emissions-calculator
1.4	CarbonScope – Carbon Footprint Calculator	https://www.carbonscope.net/

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1.4	GHG Protocol Tools and Guidance	https://ghgprotocol.org/calculation-tools-and-guidance
1.4	C2C (Cradle-to-Cradle) Certified Product Standard	https://c2ccertified.org/
1.4	Circular IQ - Circular Economy and Cradle-to-Cradle (C2C) Tool	https://circular-iq.com/
1.4	World Resources Institute (WRI) Aqueduct – Water Resource Analysis Tool	https://www.wri.org/aqueduct
1.4	Water Footprint Network Interactive Tools	https://www.waterfootprint.org/resources/interactive-tools/
1.4	Ansys Fluent – Fluid Simulation Tools	https://www.ansys.com/products/fluids/ansys-fluent
1.4	COMSOL Multiphysics – Fluid Simulation Tools	https://www.comsol.com/
1.4	Aspen Supply Chain Planner	https://www.aspentech.com/en/products/msc/aspen-supply-chain-planner
2.5.1	SBTi (Science-Based Targets initiative)	https://sciencebasedtargets.org/
2.5.1	UN Sustainable Development Goals (UNSDGs)	https://sdgs.un.org/goals
2.5.1	Greenhouse Gas (GHG) Protocol	https://ghgprotocol.org/
2.5.1	International Organization for Standardization (ISO)	https://www.iso.org/home.html
2.5.1	Sustainability Accounting Standards Board	https://sasb.ifrs.org/
2.5.2	Global Reporting Initiative (GRI)	https://www.globalreporting.org/
2.5.3	Sustainalytics - Ratings	https://www.sustainalytics.com/
2.5.3	MSCI (Morgan Stanley Capital International) - Ratings	https://www.msci.com/
2.5.3	EcoVadis - Ratings	https://ecovadis.com/
2.5.3	GRESB (Global Real Estate Sustainability Benchmark) - Ratings	https://www.gresb.com/nl-en/
2.7	Federal Supplier Climate Risks and Resilience Rule	https://www.sustainability.gov/federalsustainabilityplan/fed-supplier-rule.html
2.7.2	Greenhouse Gas Reporting Program	https://www.epa.gov/ghgreporting
2.7.2	U.S. EPA's Clean Air Act	https://www.epa.gov/laws-regulations/summary-clean-air-act
2.7.2	Mandatory Greenhouse Gas Reporting (40 CFR Part 98)	https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-98?toc=1
2.8	California Environmental Quality Act (CEQA)	https://www.lci.ca.gov/ceqa/
2.8	Georgia Environmental Policy Act (GEPA)	https://www.dot.ga.gov/PartnerSmart/DesignManuals/Environmental/GDOT-EPM-Chap10.pdf
2.8	Minnesota Environmental Policy Act (MEPA)	https://ceq.doe.gov/docs/laws-regulations/state_information/MN_NEPA_Comparison_23Nov2015.pdf
2.8	New York State Environmental Quality Review Act (SEQRA)	https://dec.ny.gov/regulatory/permits-licenses/seqr
2.8	State Environmental Policy Act (SEPA)	https://ecology.wa.gov/regulations-permits/sepa/environmental-review
2.9.1	European Climate Law	https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32021R1119
2.9.2	2030 Agenda for Sustainable Development	https://sdgs.un.org/2030agenda
2.9.3	Financial Stability Board	https://www.fsb.org/
2.9.4	International Sustainability Standards Board	https://www.ifrs.org/groups/international-sustainability-standards-board/
2.9.5	Corporate Sustainability Reporting Directive	https://finance.ec.europa.eu/capital-markets-union-and-financial-markets/company-reporting-and-auditing/company-reporting/corporate-sustainability-reporting_en

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2.9.6	The European Green Deal	https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en
2.9.6	Sustainable Finance Taxonomy	https://finance.ec.europa.eu/publications/renewed-sustainable-finance-strategy-and-implementation-action-plan-financing-sustainable-growth_en
2.9.6	Carbon Border Adjustment Mechanism	https://taxation-customs.ec.europa.eu/carbon-border-adjustment-mechanism_en
2.9.7	TCFD guidelines	https://www.fsb-tcfd.org/recommendations/
2.9.8	Japan's Corporate Governance Code	https://www.jpx.co.jp/english/news/1020/b5b4pj0000046kxj-att/b5b4pj0000046l0c.pdf
3.5	ISO 50001	https://www.iso.org/iso-50001-energy-management.html
4.2.10	South Carolina Department of Environmental Services	https://des.sc.gov/
5.1.2	World Resources Institute (WRI)	https://www.wri.org/
5.1.2	Corporate Accounting and Reporting Standard (CARS)	https://ghgprotocol.org/corporate-standard
5.1.3	Specific, Measurable, Achievable, Relevant, and Time-bound (SMART)	https://www.atlassian.com/blog/productivity/how-to-write-smart-goals
Climate Change	U.S. EPA Climate Change	https://www.epa.gov/climate-change
ENERGY STAR	Industrial Energy Management	https://www.energystar.gov/industrial_plants?s=mega
Decarbonization	U.S. DOE Decarbonization Program	https://www.energy.gov/topics/decarbonization
Net-Zero	U.S. DOE Net Zero Economy	https://www.energy.gov/topics/net-zero-economy
Circularity/ Recycling	U.S. EPA Sustainable Materials Management	https://www.epa.gov/smm
Energy Efficiency	Database of State Incentives for Renewables & Efficiency (DSIRE)	https://www.dsireusa.org/
Energy Efficiency / Renewable Energy	U.S. DOE Office of Energy Efficiency and Renewable Energy (DOE EERE)	https://www.energy.gov/eere/office-energy-efficiency-and-renewable-energy
Energy Efficiency / Renewable Energy	DOE EERE - Advanced Materials and Manufacturing Technologies Office	https://www.energy.gov/eere/ammto/advanced-materials-and-manufacturing-technologies-office
Energy Efficiency / Renewable Energy	DOE EERE - Industrial Efficiency and Decarbonization Office	https://www.energy.gov/eere/iedo/industrial-efficiency-and-decarbonization-office
Renewable Energy	National Renewable Energy Laboratory (NREL)	https://www.nrel.gov/
Recycling	U.S. EPA WasteWise	https://www.epa.gov/smm/wastewise
Recycling	SC Department of Environmental Services - SC Smart Business Recycling Program	https://des.sc.gov/community/recycling-waste-reduction/smart-business-recycling-program
Recycling	SC Department of Environmental Services - Recycling & Waste Reduction	https://des.sc.gov/community/recycling-waste-reduction
Recycling	SC Department of Commerce - Recycling Market Development Program	https://www.recyclinginsc.com/
Recycling	S.C. Department of Commerce - Recycling Business Directory	https://www.recyclinginsc.com/directory/
Resilience	South Carolina Office of Resilience	https://scor.sc.gov/
Trade Associations - Energy	E4 Carolinas	https://www.e4carolinas.org/Home
Trade Associations - Recycling	South Carolina Solid Waste Association of North America (SCSWANA)	https://scswana.wildapricot.org/
Trade Associations - Solar	South Carolina Solar Council	https://www.scsolarcouncil.org/
Trade Associations - Sustainability	Sustain SC	https://www.sustainsouthcarolina.org/

SCMEP

SCMEP.ORG

SCMEP is a not-for-profit 501(c)3 organization affiliated with The National Institute of Standards and Technology's (NIST) Hollings Manufacturing Extension Partnership (MEP), a network of 51 MEP Centers located in all 50 states and Puerto Rico.