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Article 3 in a series of 7
February 2024

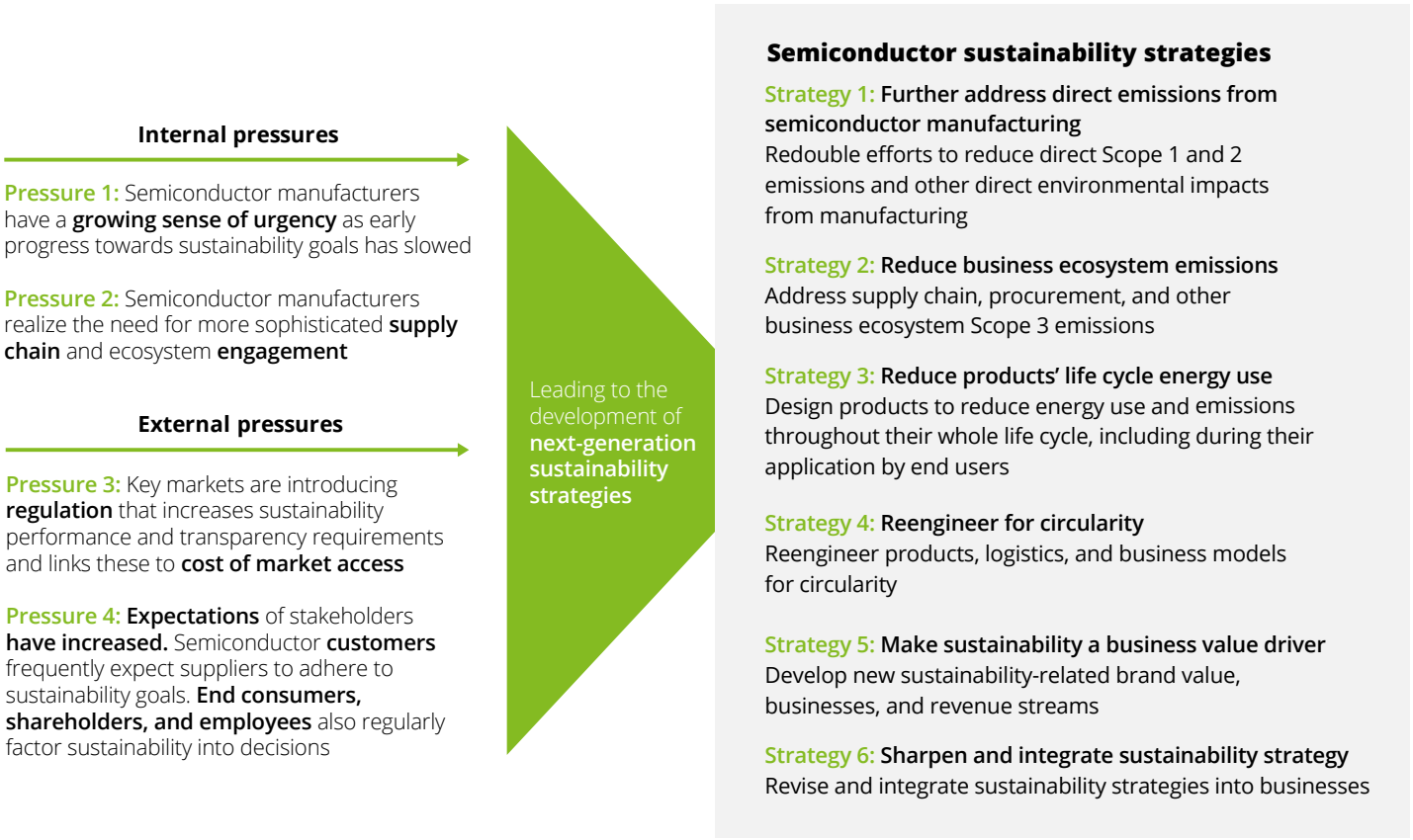
Semiconductor sustainability trends

Strategy 2: Chip companies are addressing Scope 3 supply chain, procurement, and business ecosystem emissions

Series overview

As illustrated in the graphic below, through our experience in the sector Deloitte sees four broad sources of pressure toward increased sustainability in the semiconductor sector. Companies' responses are coalescing into six next generation semiconductor sustainability strategies.

Sustainability pressures and strategies in today's semiconductor sector



This article discusses the specific drivers and the distinct solutions that companies are implementing to pursue Strategy 2: addressing Scope 3 supply chain, procurement and business ecosystem emissions.

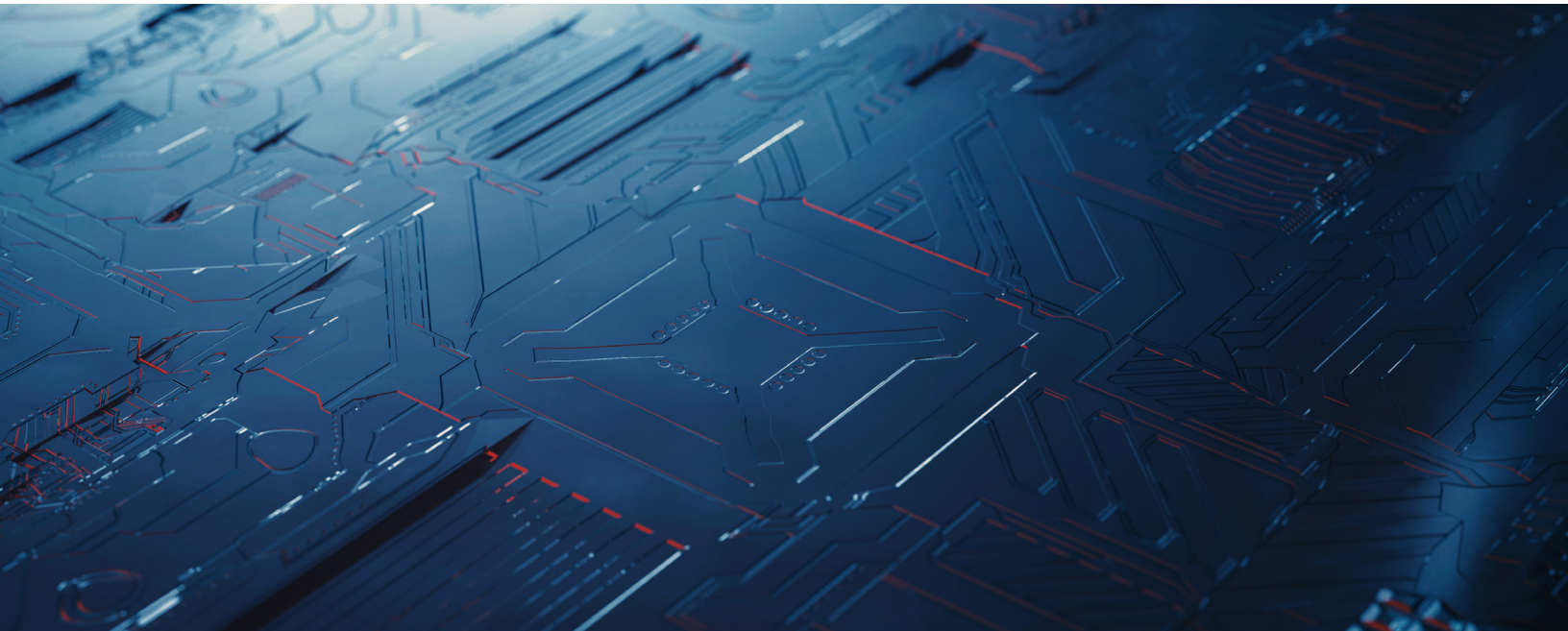
Context

The semiconductor sector produces greenhouse gas emissions through the assets and processes they own (Scope 1), the energy they purchase (Scope 2), and indirectly through the upstream and downstream activities across their supply chains (Scope 3). Many semiconductor companies declared both environmental, social, and governance (ESG) goals and emissions reduction goals several years ago, with target dates for achieving net-zero emissions generally ranging from 2030 to 2040. Although opportunities remain to further reduce Scope 1 and 2 emissions, progress has been achieved. A large global semiconductor manufacturer, for example, built a regenerative catalytic facility to reduce the fuel and heat requirements for treating process gas, contributing to doubling its rate of annual emissions reduction from 2018 to 2021.[1]

As illustrated in the following graphic, industry leaders are now addressing the more challenging Scope 3 emissions across their value chain. This requires deeper engagement with the supplier ecosystem, coordinating commitments, incentives, and actions to reduce emissions throughout the web of corporations and facilities which participate in the design-source-fabricate-test-assemble-distribute chain—as well as during product use and at end-of-life. This can be especially challenging for fabless semiconductor companies with less influence over the complex and energy intensive processes of wafer manufacture, oxidation, photolithography, etching, deposition, metalization, testing and packaging, and more.

Achieving social, environmental, and climate sustainability goals is best achieved through engagement across the full semiconductor value chain

	Design	Fabrication	Test & assembly	Application	End of life
Environment	Customers may want help designing products that **do not negatively impact** society/the environment (e.g., ICE vehicles) Chip design often requires the use of **toxic materials** (e.g., arsenic, cadmium, tellurium, etc.), and **customers** can be reluctant to adopt alternative new materials Design and research labs and facilities use **energy** (usually generated from fossil fuels) and generate **waste**	Foundries require **extensive amounts of energy,** mostly generated from fossil fuels, and large amounts of **water**, depleting local resources and generating wastewater **Renewable energy** availability is often insufficient to meet fabrication processes needs Fabs require the use of GHG **fluorinated chemicals** Emissions are generated during the **transport** of wafers to test and assembly facilities	Testing and assembly plants require **extensive amounts of energy,** mostly generated from fossil fuels, and large amounts of **water**, depleting local resources and generating wastewater **Renewable energy** availability is often insufficient to meet processes needs **Chemicals** are used in test and assembly processes Emissions are generated to manufacture and transport **packaging**	Semiconductor manufacturers **lack control** over the ultimate impact end products have on society/the environment **Carbon is inevitably created** as a result of the end-use product creation (e.g., carbon generated to manufacture EVs) and/or end applications (e.g., electricity used to charge EVs is not "green")	Semiconductor manufacturers often lack control over the process by which its products are recycled and **disposed of**, which may contribute to electronic waste
Social	Engineering workplace is traditionally **male dominated** and not **socially diverse** Ineffective communication of product impact narrative can negatively impact employee **engagement** and **retention** Some chips are designed to be built using **conflict minerals**	Supply chain partners may hold different **social** and **ethical standards** (e.g., child labor, human rights, employee benefits, etc.) **Local and diverse suppliers** tend to be outcompeted by large multinationals	Employee and community needs vary across global offices and the US, necessitating different talent programs and engagement strategies Building **global cohesion** and a **consistent talent experience** across the workforce presents many challenges	Semiconductor company employees often lack understanding of the **impact** on end applications, society, or the environment	Semiconductor manufacturers often lack control over **disposal locations** of its products, which may not be ethical (e.g., foreign countries with high poverty rates)



Drivers

How is momentum for Scope 3 emissions reduction manifesting for semiconductor manufacturers?

Drivers and solutions for addressing supply chain sustainability in today's semiconductor sector

Internal drivers

Driver 1: Continued progress toward **net-zero goals** requires engaging suppliers to **address Scope 3** emissions

Driver 2: Supply chain disruptions during the COVID-19 pandemic exposed the **vulnerability of semiconductor companies**

External drivers

Driver 3: **Stakeholder** awareness of indirect emissions is leading to **pressure for action**

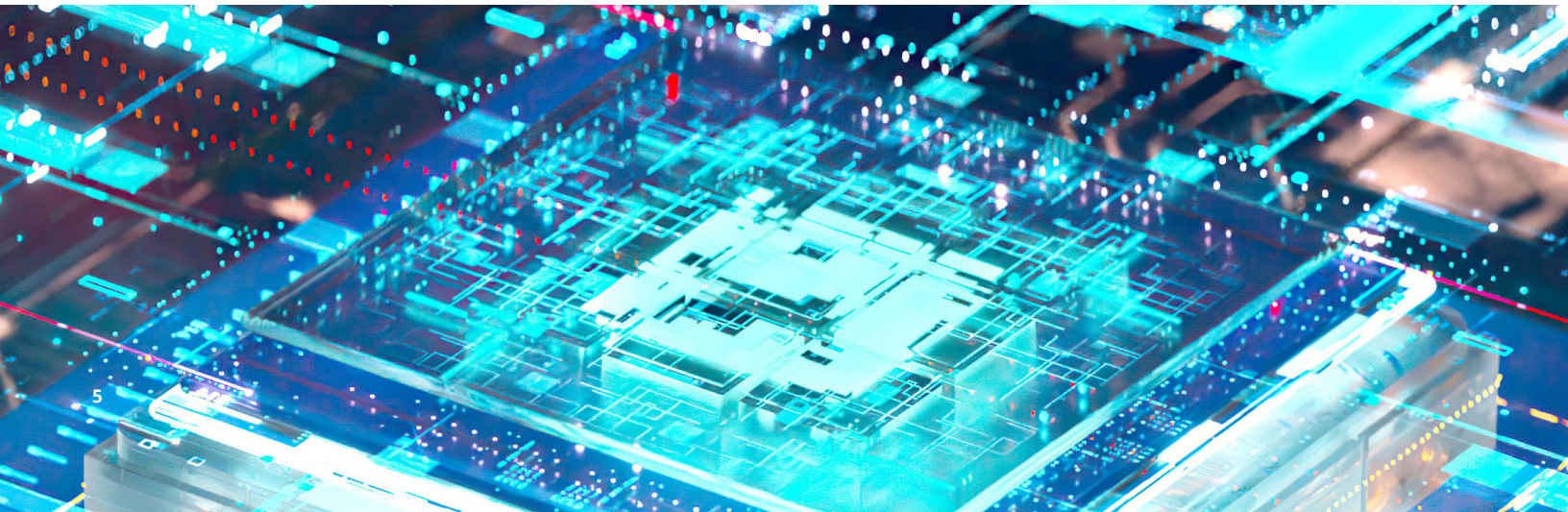
Driver 4: Scope 3 emissions have become **more addressable at scale**

Leading to implementation of **supply chain sustainability solutions:**

Solution 1: Develop procurement **emissions abatement plans**

Solution 2: Engage and **partner with suppliers** to achieve emissions reductions

Solution 3: Address the full span of Scope 3 emissions **beyond the supplier base**



Deloitte's experience highlights the varied influences toward addressing emissions and other sustainability challenges across the semiconductor value chain being expressed via four drivers:

Driver 1. Continued progress toward net-zero goals requires building on gains from Scope 1 and 2 emissions by asking suppliers to address Scope 3 impacts

Many semiconductor companies were quick to embrace efforts to reduce Scope 1 and Scope 2 emissions due to this often making business sense for the organization. Initiatives to reduce emissions from facilities often coincide with efficiency gains and operational cost savings. Scope 3, on the other hand, is more of a challenge since companies tend to have less control over their supplier network. Nevertheless, semiconductor companies increasingly recognize that continued progress toward their emissions reduction goals requires engaging supplier networks to address Scope 3.

Driver 2. Supply chain disruptions during the COVID-19 pandemic exposed the vulnerability of semiconductor companies

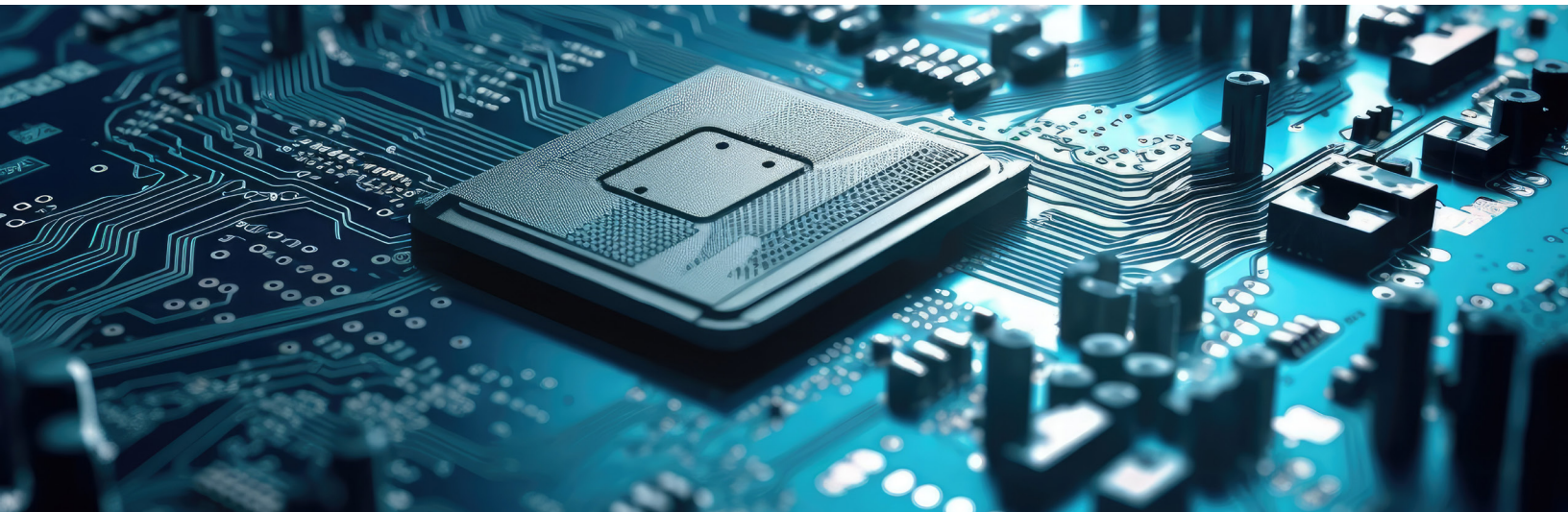
Many of us experienced shortages during the COVID-19 pandemic and its aftermath. While the availability of chips to auto manufacturers received the greatest press coverage, disruptions were widespread and this led businesses to revisit how they design, manage, and engage their supply chains. Efforts to address the resilience of supply chains have often gone hand-in-hand with initiatives to address Scope 3 emissions.

Driver 3. Stakeholder awareness of indirect emissions is leading to pressure for action

Consumers, customers, regulators, and media are becoming more sophisticated and understand that even the products of a company that has strongly addressed Scopes 1 and 2 frequently still have significant embedded Scope 3 emissions (e.g. supplier emissions, end of life emissions). Consumer choices and business decisions are considering Scope 3 emissions, increasing competitive, market and regulatory pressure for action.

Driver 4. Scope 3 emissions have become more addressable at scale

Perhaps more of an enabler than a true driver, experience is making Scope 3 emissions much easier to address. The management steps involved are clearer (see next section), supply chain management systems have advanced, new manufacturing technologies have been developed, and opportunities to capture value from Scope 3 emissions reductions through carbon insetting and offset markets have presented themselves.



Solutions

In response to these drivers, semiconductor companies are pursuing a strategy of reducing Scope 3 emissions. What solutions will advance this strategy?

Solution 1. Develop procurement emissions abatement plans

Semiconductor manufacturers are engaging their suppliers in shared programs to address social and environmental sustainability objectives, including energy and water use, high global warming potential (GWP) gas use, and social/workforce topics. The first step is to assess the relative emissions intensity across procurement categories. The focus of this assessment can be supply-base wide; specific to a subset of spend categories; or targeted to specific high priority suppliers. The goal is to characterize suppliers based on factors such as value to the business, risk, and emissions levels.

The next step is to evaluate the emission abatement potential and relative cost of abatement across supplier segments, to identify which suppliers have relatively high emissions intensity and are also amenable to emission reduction. Various abatement analytic tools and technology libraries are available to inform this process. The outcome is a long-term plan for supplier engagement and emission reduction.

Solution 2. Engage and partner with suppliers to achieve emissions reductions

The key to effective Scope 3 action lies in effective collaborations with supply chain partners. Semiconductor companies have increased their focus on program development with their suppliers to address environmental topics such as energy and water usage, as well as the social and workforce topics. Intel, for example, says that the road to full transparency in raw material origins is a long one. This has not stopped the company from pursuing Scope 3 levers in sustainable procurement through on-site reviews of smelters, participating in pilots for "conflict free" minerals, and forming new partnerships to establish a Public-Private Alliance for the Responsible Minerals Trade.[2]

Implementing a supplier emissions reduction program spans a range of topics from design of incentives, alignment on common goals, agreements on reporting approaches and more. As illustrated in the graphic, supplier engagement models vary in their reliance on collaboration, delegation, incentives, and enforcement approaches. Each approach calls for its own supplier relationship management, KPIs, and scorecards to address the supplier segments identified. Increasingly, procurement systems are being enhanced to support these considerations.

Varying supplier engagement models

Solution 3. Address the full span of Scope 3 emissions beyond the supplier base

Sustainable procurement represents a portion of the broad Scope 3 landscape. As illustrated in the below graphic, ultimately semiconductor companies need to address how efficiently their products are transported, how they are used during application, and what happens to the products at end of life.

Levers for addressing the full range of Scope 3 emissions in today's semiconductor sector

Sustainable procurement	Circularity & waste	Logistics & transportation	Portfolio management	Energy transition
Process of **purchasing goods and services** in a way that considers the social, economic, and **environmental impacts of those purchases**	Practice of **designing, producing, and consuming goods** in a way that minimizes waste, extends the lifespan of products, and promotes materials recovery and recycling in a **closed-loop system**	Planning, management, and **movement of goods and people** from one location to another in a way that optimizes operations and **reduces carbon emissions**	Process of strategically selecting and **managing a group of investments** with regard to their environmental impact	Collaborating with **both upstream and downstream partners** to shift from fossil-based energy sources toward **renewable energy sources**
Category 1 Purchased goods & services **Category 2** Capital goods	**Category 5** Waste generated in operations **Category 10** Processing of sold product **Category 11** Use of sold product **Category 12** End-of-life treatment of sold product **Category 13** Downstream leased assets	**Category 4** Upstream transport & distribution **Category 6** Business travel **Category 7** Employee commuting **Category 9** Downstream transport & distribution	**Category 14** Franchises **Category 15** Investments	**Category 3** Fuel & energy-related activities **Category 8** Upstream leased assets **Category 10** Processing of sold product

The bottom line

A broad range of stakeholders increasingly expect companies to take responsibility for the climate and other sustainability impacts not just in their own direct operations, but across their full supply chain. Semiconductor companies acknowledge this expectation, and recognize the supply chain resilience and efficiency benefits that can flow from comprehensively responding. Fortunately, the range of approaches and supporting systems available to enable the tracking and reduction of supply chain emissions is greater now than ever.

Contact

Jordan Bish
Semiconductor leader
jbish@deloitte.nl

Jordan is a partner in the Consulting practice of Deloitte Netherlands and serves as both the NSE/NL Technology sector Leader as well as the NSE Semiconductor COE Leader. He has 17 years of strategy and transformation consulting experience in the TMT industry working at key clients in Europe as well as the US. Jordan is excited about working with Technology companies who are enabling change for all industries as well as society at large.

Endnotes

1. Samsung, "Reducing greenhouse emissions through sustainability efforts," Samsung Semiconductor Global, accessed November 2023.
2. Gary Niekerk, Bob Leet, and Andrea Fava, "Intel's efforts to achieve a 'conflict-free' supply chain," Intel, 2011.

About Deloitte's *Semiconductor Sustainability* series of articles

Clients and other industry actors are interested in learning about the broad trends and patterns that we see in our work in the semiconductor sector, and interest is especially high in the critical task of driving sustainability through their operations and ecosystems.

Deloitte's series of short Semiconductor Sustainability articles responds to this interest by summarizing emerging sustainability strategies that Deloitte is seeing through our work with clients. Each article is intended to be a short, accessible summary that can be read in less than 20 minutes. We hope that the series proves useful to anyone interested in how the semiconductor sector is working to address its sustainability challenges.

Below is a list of all the articles in this series, in order of publication:

Series overview: Current sustainability pressures and next-generation sustainability strategies in the semiconductor sector

Strategy 1. Further address direct emissions from semiconductor manufacturing
Semiconductor companies are redoubling efforts to reduce direct Scope 1 and 2, greenhouse gas emissions, other environmental impacts from manufacturing.

[This article] Strategy 2. Reduce business ecosystem emissions
Semiconductor companies are addressing supply chain, procurement, and other business ecosystem Scope 3 emissions.

Strategy 3. Reduce products' life cycle energy use
Semiconductor companies are designing products to reduce energy use and emissions throughout their full life cycles.

Strategy 4. Reengineer for circularity
Semiconductor companies are reengineering products, logistics, and business models for circularity.

Strategy 5. Make sustainability a business value driver
Companies in the semiconductor sector are developing new, sustainability-related brand differentiation, businesses, and revenue streams.

Strategy 6. Sharpen and integrate sustainability strategy
Semiconductor leaders are strengthening sustainability strategies and integrating them into the businesses.

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