

CLIMATE TRANSITION ACTION PLAN AND EMISSION REDUCTION STRATEGY FOR SEMI-CONDUCTOR MANUFACTURER

Prepared by:

Sara Diamond, Francisco Tomasino and Xianhang Xie

Prepared for:

Wolfspeed

Client Advisors:

Sona Stenclova, Robin Housh, Nathan Daigle

Faculty Advisor:

Dr. Jeremy Pare

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Executive Summary

As the threat of climate change continues to grow, corporations are being asked to reduce their emissions and set goals in line with a net zero future by 2050. Many of these net zero goals are paired with interim targets which are goals that push companies to reach set thresholds by a given year.

Wolfspeed, a key player in the global expansion of Silicon Carbide and GaN technologies, provides groundbreaking solutions to address the continuous challenges of energy efficiency and sustainability for a more resilient future. Wolfspeed's range of products include Silicon Carbide materials, power and radiofrequency devices designed for a range of application, such as rapid charging of electric vehicles, 5G communication networks, renewable energy and storage, and in aerospace and defense technologies. Wolfspeed has set a goal for Scope 1 and 2 to be net zero by 2050 and an interim target to reach a 50% reduction in Scope 1 and 2 emissions by 2030 compared to a 2019 baseline. The investor and greater stakeholder environment have added pressure on Wolfspeed to not only act on its goals, but also provide greater transparency to the means by which they will reach their goals. In response, Wolfspeed has begun developing its first climate transition action plan.

Wolfspeed's climate transition action plan (or CTAP) should contain CDP's six guiding principles: accountability, internally coherent, forward-looking, time bound and quantitative, flexible, and responsive, and complete. Wolfspeed should utilize CDP's guiding principles in conjunction with We Mean Business Coalition's four core components of a CTAP which include an emissions reduction strategy, proper governance and business strategy integration, an action plan regarding plans for public policy advocacy, and how Wolfspeed plans to foster a just transition.

In this paper, we will expand on the elements of a proper CTAP and will explore several actions we have identified that Wolfspeed can take to decarbonize and halve their scope 1 and 2 emissions by 2030. Of the 13 pathways to decarbonization we present, we will take a closer look at the six actions that are realistic to deploy and timely. These six actions are focused on the following areas: abatement systems, executive compensation and incentives, potential changes to the Greenhouse Gas Protocol, value stream engagement, an electric purchasing policy, and implementation of an internal carbon price.

Introduction:

Background

With the increased negative effect of human greenhouse gas emissions, it is necessary to take action to mitigate greenhouse gases (GHG). The United States Environmental Protection Agency (EPA) reports that extreme climate change can cause an increased risk of heat-related illness and air pollution and reduce crop yields. In addition, the rise of sea levels can erode and inundate coastal ecosystems and eliminate wetlands (*AR4 Climate Change 2007: The Physical Science Basis — IPCC, 2007*). Human activities are responsible for most of the increase in greenhouse gases in the atmosphere over the last 150 years (*AR4 Climate Change 2007: The Physical Science Basis — IPCC, 2007*). To alleviate the tendency, companies are needed to design and implement climate transition plans.

Greenhouse Gases

Gases that trap heat in the atmosphere are called greenhouse gases and 79% of greenhouse gas emissions are carbon dioxide (*AR4 Climate Change 2007: The Physical Science Basis — IPCC, 2007*). According to the GHG Protocol corporate standard, Scope 1 emissions are direct emissions from company-owned and controlled resources. Scope 2 emissions are indirect emissions from the generation of purchased energy, from a utility provider. Scope 3 emissions are all indirect emissions, not included in Scope 2 that occur in the value chain of the reporting company (*AR4 Climate Change 2007: The Physical Science Basis — IPCC, 2007*).

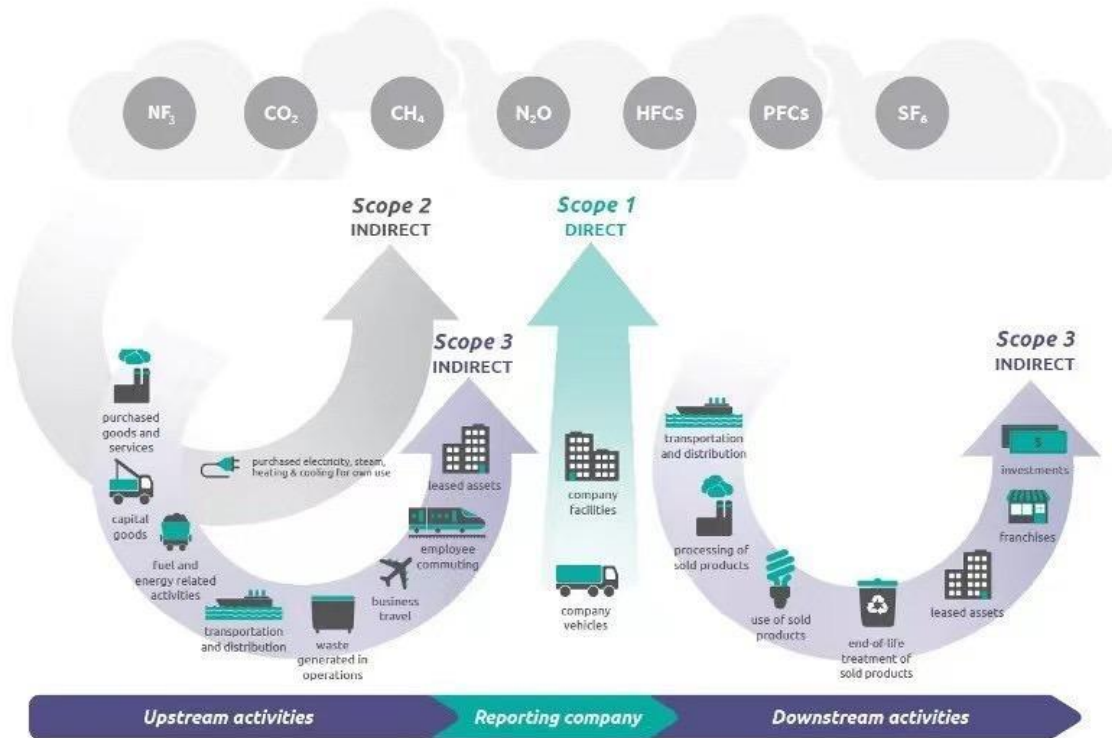


Figure 1: Overview of GHG Protocol Scopes and emissions across the value chain

Importance of Transition Plan

As the impacts of climate change become more frequent, we need to halve carbon emissions by 2030 and reach a net-zero economy by 2050 at the latest. That means emissions need to reduce by 7% per annum out to 2030—and companies have a fundamental role to play (*AR4 Climate Change 2007: The Physical Science Basis — IPCC, 2007*). Nowadays, transition plans are executed by many well-known corporations. For instance, Microsoft is going to update its supplier code of conduct to require suppliers to report and reduce their carbon emissions. Furthermore, Mercedes-Benz is planning to build a strategy to address the net-zero transition impact on employees to reach their net-zero goal. Additionally, Nike is implementing leverage financing mechanisms to support suppliers (*AR4 Climate Change 2007: The Physical Science Basis — IPCC, 2007*). In addition, Amazon is planning to reach net-zero carbon emissions across our operations by 2040, which is ten years ahead of the Paris Agreement. (*Delivering Progress Every Day Amazon's 2021 Executive Summary*)

Client Problem

Founded in 1987, Wolfspeed is a leading company in the semiconductor market, focusing on Silicon Carbide (SiC) and gallium nitride materials and devices for power and radio frequency applications. Wolfspeed has a global footprint in North America, Asia, and Europe with 4,500 employees (*About | Global Leader in Silicon Carbide*, n.d.). As an international firm with social responsibility, Wolfspeed is aiming to reduce Scope 1 and 2 greenhouse gas (GHG) emissions by 50% in 2030 and reach net zero by 2050 (*About | Global Leader in Silicon Carbide*, n.d.). To achieve this challenging goal, Wolfspeed's climate transition plan is going to be based on four key elements: governance, strategy, risk management, and metrics & targets. As Carbon Disclosure Project (CDP) suggested, the entire climate transition plan should follow six guiding principles: accountability, internally coherent, forward-looking, time-bound, and quantitative, flexible and responsive, and complete (*Climate Transition Plan: Discussion Paper*, 2021).

The largest contributor to emissions within Scope 3 is the use phase of Wolfspeed's products (Long and Kikuma, 2018). The second largest number of emissions is from purchased goods and services (Long and Kikuma, 2018). To reach the sustainability goal, Scope 3 will be the crucial factor during the entire project. With a customer and supplier base that spans the globe, it will take wide-reaching efforts to effectively reduce Wolfspeed's greenhouse gas emissions. Of the purchased goods and services, it makes sense to start with the Tokyo facility which accounts for nearly 73% of that category.

Objectives

To effectively address Wolfspeed's need to create a climate action plan, our group has come up with the following objectives to meet the needs of Wolfspeed:

- What are the necessary elements of a successful climate action plan?
- What are the current gaps in Wolfspeed's sustainability goals and where can we provide recommendations to close these gaps?

- What are specific, actionable, future steps that we can suggest to Wolfspeed in the climate action plan for them to be a sustainability leader in their industry?

Methodology:

Background

Originally known as Cree, Wolfspeed, an American company, develops and manufactures wideband semiconductors including silicon carbide and gallium nitride (GaN) materials and devices for power applications and radiofrequency (RF) communications. (*Financials - Annual Reports - Wolfspeed, Inc.*, n.d.). Wolfspeed was founded in Durham, North Carolina, in 1987. Wolfspeed commercialized the world's first blue LED and had their IPO in 1993 (*Financials - Annual Reports - Wolfspeed, Inc.*, n.d.). With the development in the past few decades, Wolfspeed's current footprint is across North America, Asia, and Europe and has over 4,500 employees (*The New Wolfspeed*, n.d.).

Products

It has been Wolfspeed's mission to focus on the future from the beginning. A combination of Silicon Carbide Power and GaN on Silicon Carbide RF solutions can speed up your business. (*SiC Power & GaN on SiC Products*, n.d.). The general products are divided into four major categories: power products, radiofrequency (RF) products, online foundry training courses, and materials products. Electric vehicles, fast charging, 5G, renewable energy and storage, aerospace, and defense are among the applications targeted by the products. There are certain specific products under each of the categories.

Previous Master's Projects

Wolfspeed has a long and solid relationship with Duke University. In the past, several projects have been done with Duke University. The project to set sustainability goals for Wolfspeed is done in April 2021 by the Duke team. The aim of reducing direct (Scope 1 and 2) greenhouse gas emissions by 50% will be achieved by using affordable and clean energy. (Abdullah et. al., 2021) The analysis of Cree's 2016 Scope 3 greenhouse gas emissions project was done in May 2018. The team uses competitor assessment and modeling to calculate and estimate the Scope 3 emissions during the entire life cycle phase. Consequently, product use might be the biggest emitter of greenhouse gases, except for raw materials. (Lesser, 2018). For the evaluation of upstream Scope 3 emissions for Cree Inc.'s project and setting science-based targets, the team used the economic input-output (EIO) LCA model and Quantis tool. The study reveals that most of their emissions are indirect emissions within their value chain and fall within Scope 3, particularly downstream Scope 3. (Daystar, 2020). In the corporate-wide sustainability goals for the Wolfspeed project, it is recommended that Wolfspeed ensures the implementation of the sustainability goals on the ground. Creating a sustainability committee and developing an internal and external communication plan are suggested by the team. In addition, an internal communication plan can connect employees under the banner of sustainability and can show the importance and significance of sustainability in the company. (Abdullah et. al., 2021). These action plans are based on interviews, competitor analysis, and maturity curves.

Sustainability at Wolfspeed

Sustainability is a core corporate value for Wolfspeed. Wolfspeed's sustainability project included different areas such as health, community, energy, water, waste, and supply chain. In the greenhouse emission reduction area, as part of our efforts to combat climate change, Wolfspeed actively reduces the carbon footprints of itself and others. As part of Wolfspeed's GHG emissions reduction plan, the company plans to reduce Scope 1 and 2 greenhouse gas (GHG) emissions by 50% by 2030. Achieve net zero GHG emissions by 2050 for Scope 1 and 2. Furthermore, Wolfspeed is also planning to take a further step in the Scope 3 emission reduction.

In June 2015, Woldspeed completed its first companywide GHG emissions assessment. One year later, Wolfspeed finished the first submission of GHG emissions to CDP. In September

2017, First time Wolfspeed estimates its Scope 3 GHG emissions. In addition, Wolfspeed's EV chargers were used by employees in 2018 to reduce greenhouse gas emissions by 7,480 kg, equivalent to planting 192 trees and letting them grow for ten years. (*Sustainability*, n.d.).

Site visit

On January 20, 2023, our team visited Wolfspeed's facility in Durham, North Carolina facility. The Wolfspeed team introduced us to their current sustainability actions and plans during our visit. In addition, we visited the production of semiconductors and wafers with the commentary by staff. After the tour, our team had a better understanding of the manufacturing process of semiconductors and how the sustainability work should be done.

Research of Existing Climate Transition Action Plans

For our group to accurately provide recommendations on how to best form a climate transition action plan (CTAP) for Wolfspeed, we took two different approaches in our methodology.

First, we identified CTAPs that currently exist. As it is a relatively new aspect of a corporation's sustainability journey and strategy, we did not have many existing CTAPs available to us as we would have hoped. However, the ones that do exist were helpful in providing guidance as to what one should include. We understood that CTAPs could be incorporated into an existing Sustainability Report, but the most compelling examples we found were separate reports that focused only on climate and reduction goals. Some examples of a CTAP that we found to be particularly useful were Unilever and Jacobs. They set an exceptional example of the overall format of CTAP and what parts should be addressed to make their goals and expectations clear to all their stakeholders. Evaluating CTAPs like these two companies was helpful in establishing a baseline of what we can share with Wolfspeed as they look to build their own CTAP.

Our second approach focused specifically on pinpointing best practices and elements that must be included when creating a CTAP. This was mostly done by reviewing articles or guides published by various companies such as CDP, We Mean Business Coalition (WMBC), Environmental Defense Fund + Business (EDF) and Ceres. These companies have published useful discussion guides on what should be included in CTAPs and their methodology on how

they determined which components are most useful and impactful in a CTAP. Additionally, many of these documents provided step-by-step instructions on how to achieve climate and emission reduction goals and how this can be accurately communicated through a CTAP. From these guides, we not only learned exactly which recommendations we can provide Wolfspeed for their CTAP, but we also identified strategies that will help Wolfspeed after they develop their CTAP and how to move forward towards meeting their published climate goals.

Analysis of Wolfspeed's Greenhouse Gas Inventory (GHG)

To better understand which recommendations our group intends to provide to Wolfspeed to achieve its current emission reduction and climate goals, we needed to identify the key areas of improvement in their business operations. This was done through an in-depth analysis of their GHG inventory. We analyzed Scope 1 and Scope 2 to understand where most of those emissions are coming from both on-site and from their utility purchases. We then dove into their Scope 3 inventory and looked at each one of the reported Scope 3 categories to understand the magnitude that each one of them plays in the total makeup of their emissions. This was essential to recognize the greatest areas of opportunity in Wolfspeed's climate and sustainability strategy and allowed us to hone in on specific areas of interest such as individual suppliers, facilities or products that have the largest impacts in the breakdown of their total emissions.

Identifying Feasible Solutions for Wolfspeed Climate Goals

The last, and arguably, the most important part of our methods was identifying impactful and easy-to-implement solutions to meet Wolfspeed's published climate and emission reduction goals for both 2030 and 2050. This timely process took place in two different steps.

First, our team did extensive research on what sort of climate and emission reduction solutions already exist and are used by other corporations. We looked through a multitude of sustainability and climate action reports, which provided detailed information on how they met or intend to meet their various aggressive climate goals. The search for these solutions highlighted some of Wolfspeed's areas of improvement such as energy efficiency, supplier engagement, carbon credits/offsets, renewable energy procurement, on-site renewable energy generation and advocating for the decarbonization of the grid.

We tried to identify leaders in the corporate sustainability space who have worked tirelessly to make it part of their mission to reduce their emissions by integrating these solutions into their complete business operations. More specifically, we looked at companies that are listed as Wolfspeed's competitors or companies that exhibit similar operational and manufacturing practices to Wolfspeed. This was particularly useful in deciding which solutions would be most relevant to Wolfspeed's operations and goals based on similarities within their industry. It was also important for Wolfspeed that we addressed solutions that were pertinent to their investors and made it a priority to look into ones that they deemed as absolutely necessary. Moreover, we took advantage of our Duke faculty and network here at the Nicholas School and spoke with multiple professors to get their opinion on solutions that would be worth suggesting for Wolfspeed. We interviewed energy and transportation expert, Tim Johnson, and an experienced corporate sustainability strategy professional, Holly Emerson, who are both professors in the Nicholas School's Environmental Management Program. Lastly, some of our team attended the GreenBiz 23 Corporate Sustainability Conference, to learn from existing professionals on Scope 3 measurement and reduction strategy, decarbonizing the semiconductor industry and meeting company climate and reduction goals through a climate transition action plan.

The second part of this identification process was to create a method to rank the solutions we came up with based on three aspects: the time it takes for implementation, ease of solution for Wolfspeed (i.e., they have direct control over solution), and how large the impact the solution will have on their emission reduction goals. This process was done both quantitatively and qualitatively as we gave each solution a weight based on these three aspects. Using this process helped our team choose solutions in an unbiased and constructive manner and be thorough in our thought process of what would be most beneficial and actionable for Wolfspeed to implement.

Results and Observations

Climate Transition Action Plan

A climate transition action plan (CTAP) is a tool corporations can use to show their stakeholders that they have developed an “action-oriented and climate science-led strategy” (*Climate Transition Plan: Discussion Paper*, 2021) that will keep their business on the pathway to 1.5°C and relevant in the net zero economies. Put differently, a CTAP is a forward-looking list of actions taken in the near term to align internal strategies and external climate and energy policy advocacy to reduce greenhouse gas emissions in line with a 1.5°C pathway and achieve a just transition (We Mean Business Coalition, 2022). With CTAPs only gaining traction in the last few years, there were a limited number of resources (such as guides and discussion papers) and more so, examples. Our analysis of two sample CTAPs provided a variety of lengths, from 20 to 60 pages. In any case, we have identified several components and principles of a strong and credible plan.

From CDP (*Climate Transition Plan: Discussion Paper*, 2021), we have identified six guiding principles:

- **Accountability:** the plan has defined roles and responsibilities that hold the C-suite accountable for the plan’s delivery
- **Internally coherent:** the plan (and greater sustainability strategy) is woven into the greater business strategy and linked to profit and loss statement
- **Forward-looking:** the plan looks forward until 2050 but emphasizes the next 5 years
- **Time-bound and quantitative:** there are quantified KPIs with defined time frames
- **Flexible and responsive:** the plan is updated regularly and there are opportunities for stakeholders to provide regular feedback
- **Complete:** the plan covers the entire organization

According to the We Mean Business Coalition (WMBC), a global coalition working to act on climate change, there are four core components to a CTAP: an emissions reduction strategy, governance and business strategy integration, public policy advocacy, and a just transition. While the language between CDP and WMBC slightly differs, the overall message and requirements are the same.

Greenhouse Gas Inventory

An analysis of Wolfspeed’s 2021 greenhouse gas inventory from their 2022 sustainability report shows Scope 1 and 2 emissions were dwarfed by the scale of Scope 3 emissions. More

specifically, category 11 (the use of sold products) makes up almost 99% of the entire inventory, with Scope 1, 2, and other Scope 3 categories making up the remaining ~1%.

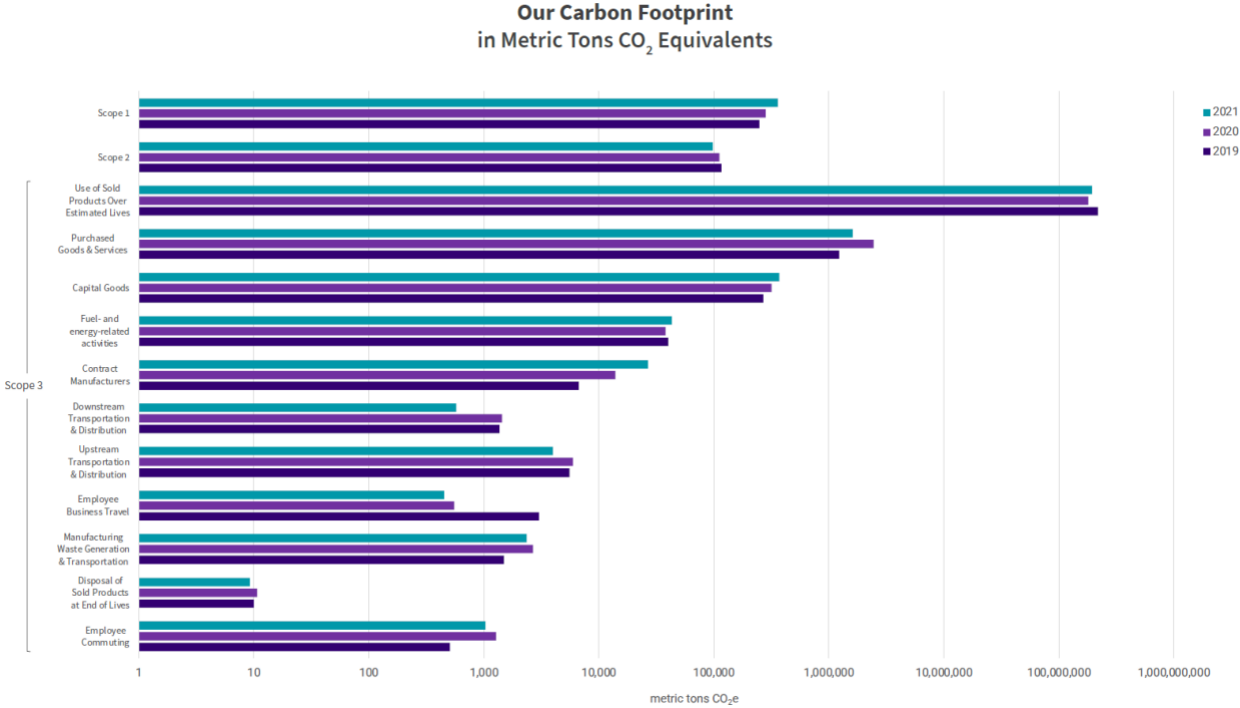


Figure 2: Wolfspeed Carbon Footprint (Wolfspeed Sustainability Report, 2022)

Because of the immense size of the use of sold products category, our group initially focused on finding strategies to reduce its impact. However, further analysis led us to better understand the lack of control that Wolfspeed has over this category. After this analysis, we concluded it would be best to take an approach that resembles that of Unilever- focus on areas that are most under your control rather than those that have the greatest impact. By focusing on what can be controlled, Wolfspeed can make more immediate action and can show that its intentions to decarbonize are genuine. Eventually, Wolfspeed will need to work to influence the categories that they do not control, but working on its own internal emissions first will provide greater leverage when doing so and will show that they lead by example.

While Wolfspeed may need to wait on tackling the use of sold products category, it can immediately take measures to reduce its Scope 1 and 2 emissions while working to influence parts of its Scope 3 emissions. To identify which emission reduction strategies Wolfspeed should act on first, we evaluated our complete suite of solutions based on three main variables:

- Likelihood or ease of implementation. How easy or hard will it be to action?
- Time to deployment or implementation. How long will it be until we see the results of our actions?
- Magnitude of Impact. How much of an impact will the strategy have on our emissions?

Based on our best estimate of each variable and the interim goal of reducing emissions by 50% by 2030, we chose to provide greater detail on strategies that would be easier to implement and have a shorter waiting period to see the impacts.

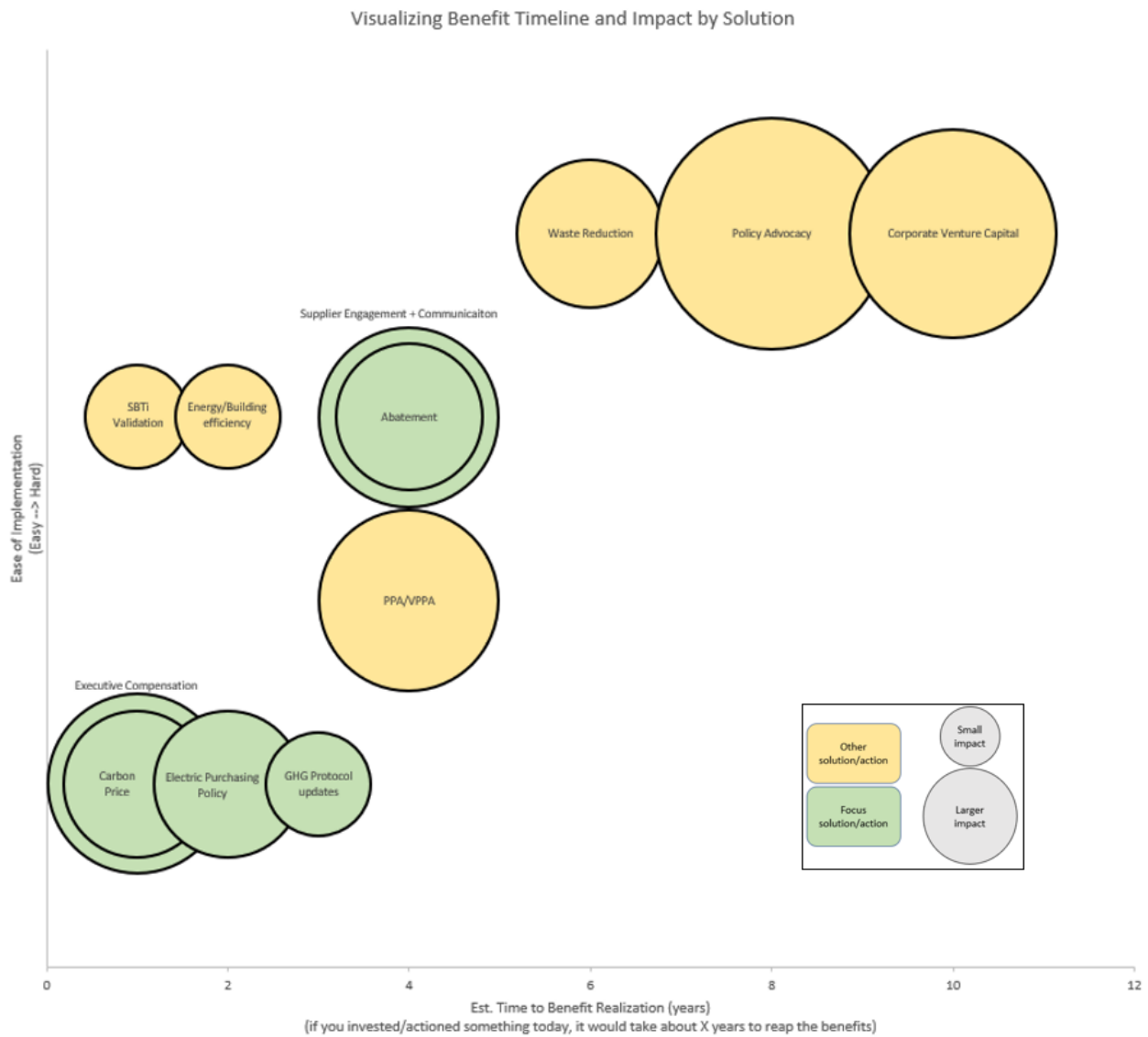


Figure 3: Emission Reduction Strategy Timeline and Impact

Discussion:

Components of a CTAP

To align organizations' climate ambitions, a climate transition plan is used. Tracking progress requires specific strategies and clear accountability mechanisms to achieve this alignment. (CDP Technical Note: Reporting on Climate Transition Plans 2023) The climate transition plan outlines a specific action plan for how a company will align its existing assets, operations, and entire business model with the latest and most ambitious climate science recommendations over a specified period. (*Climate Transition Plan: Discussion Paper*, 2021). For an organization to pivot towards a net-zero future with science-based targets (SBTs), it requires a credible climate transition plan. (*Climate Transition Plan: Discussion Paper*, 2021). An emissions reduction strategy, the integration of governance and business strategy, public policy, and transition are the four core components of a CTAP. (CLIMATE TRANSITION ACTION PLANS 2022) Climate transition plans must be accountable, internally coherent, forward-looking, time-bound, quantitative, flexible, responsive, and complete.

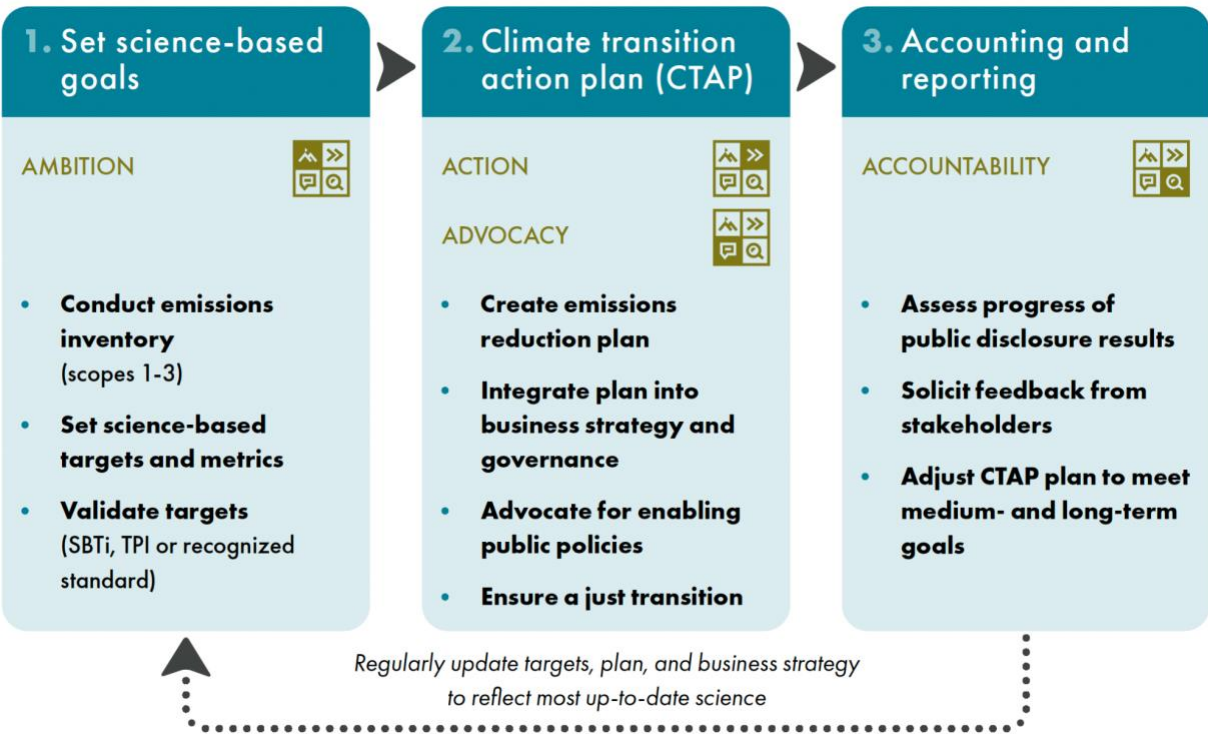


Figure 4: The Journey to Corporate Climate Credibility (*Climate Transition Plan: Discussion Paper, 2021*)

Climate transition plans must incorporate governance, strategy (scenario analysis, financial planning, value chain engagement, low carbon initiatives, and policy engagement), risk management, and metrics targets. (*Climate Transition Plan: Discussion Paper, 2021*). There are other crucial components of model climate transition plans, such as net zero-aligned carbon removal plans, transparency, and reporting (*Transform to Net Zero: What Makes an Effective Climate Transition Action Plan? n.d.*).

The WMBC offers a checklist for composing CTAPS. The questions to consider are as follows (We Mean Business Coalition, 2022):

Foundational Elements

- What is your Scope 1, 2, and 3 emissions, and have you calculated them and made them public?
- Do you have a 1.5°C-aligned target for the near term?
- Would you mind letting us know if you have published a net zero goal aligned with 1.5°C?

Emissions Reduction Strategy

- Are you aware of all the technological and financial mitigation opportunities available to you to reduce your largest sources of emissions?
- How will you align future capital expenditures with your 1.5°C targets after you have determined what investments you need to make to reduce emissions in line with your targets?
- Are you redesigning products or services to reduce emissions or developing new business lines?
- What steps are you taking to engage your supply chain in climate action?
- What procurement strategies and targets have you set for renewable energy?
- Is there a strategy and/or target you have set for energy efficiency?
- What are your goals and strategies for switching fuels and electrifying your fleet?
- What targets and strategies for zero-emission fleets have you set?

- In the case of a technical or financial limitation on an emissions reduction strategy, have you determined what other actions your company can take, such as advocating for policy reforms, to overcome this issue?
- Does the emissions reduction strategy you are deploying have any implications for a just transition?

Business strategy integration and Governance

- Do you have published assessments of physical, financial, and transition risks occurring from various climate change scenarios, and opportunities associated with 1.5°C climate change?
- What kind of oversight and competence does your board have when it comes to climate change?
- Do you agree that performance against goals is a factor in executive compensation?
- Are you addressing and acting on your company's climate goals and plan through organizational structures that incentivize the financial team, government and investor relations, research and development, procurement, and supply chain specialists?

Public policy

- Do you disclose your campaign donations, lobbying activity, and trade association memberships related to climate change?
- Have you committed to aligning policy engagement and advocacy with your company's 1.5°C targets, and do you have a plan in place to achieve that? How do you measure this alignment, and do you publicly assess it?

Transition

- Is your company considering potential climate impacts on customers, employees, and communities? Have you created definitions and used specific metrics to understand and lower these impacts?
- Is your 1.5°C transition aligned with just transition principles through formal policies (including emission reduction strategies and policy advocacy)?

After finishing the checklist, the first step is using the situation analysis model to analyze the internal and external situation of the company and set a feasible goal and outline a clear process. For instance, Wolfspeed's goal is to reduce GHG emissions by 50% by 2030 and achieve net zero by 2050. The next big step is working to create a companywide net zero mindset. (Climate transition action plan 2022) The company culture could have an important impact on the employees. Then the company should try to incorporate the decarbonization strategy into an overall strategy and act on the designed plans. For example, reduce business-travel spending. Besides, it is necessary to be transparent and have integrity throughout the process. The company should build processes to engage with internal and external stakeholders. At last, the management team should check the process periodically to ensure everything is on track.

The Four Core Components of A CTAP

The first core component is the emissions reduction strategy. The strategy should not only include what the company is taking now and what the plan is to do in the future to reach the GHG emissions reduction targets. Furthermore, the investments that the firm is making should also be considered in the protocol. These include capital investments, hiring new staff, investing in new expertise, improving processes, and deploying new technologies and designs. (WMBC Climate transition action plans 2022)

The second core component is business strategy integration and governance. To accomplish this, companies need to establish governance mechanisms. In addition, conducting scenario analysis regularly and using outputs to inform plans are important. To achieve short or long-term commitments on greenhouse gas emissions, companies should identify and implement actions to alter investment and core business model decisions. By providing details of how to compensate to reach climate goals at executive and board levels, the business strategy integration and governance component is done (WMBC Climate transition action plans 2022).

The next step is looking at the public policy part. To achieve the CTAP, Annual disclosure should be made regarding membership in trade associations and individual lobbying by companies. Moreover, the CTAP should have detailed action plans to make the company and policymakers ensure the climate goals can be done on time (WMBC Climate transition action plans 2022).

The last core component of CTAP is just transition. Analysis of negative impacts on stakeholders is crucial to avoiding and underlining their materiality. Then engage companies' workforce, vulnerable customers, and impacted communities. Finally, stakeholders should be consulted throughout the process of developing and implementing CTAPs, as well as throughout the process of selecting actions to include in them. (WMBC Climate transition action plans 2022)

Emission Reduction, Net-Zero and Climate Strategies

Throughout our work with Wolfspeed over the last year, we have gained a new perspective into their sustainability strategy and specifically their climate and reduction goals. While this project has looked at many components that are important to the future of Wolfspeed's sustainability operations and strategy, we chose to narrow our Scope to be able to provide actionable and timely solutions that were in direct control of Wolfspeed as of present. As we discuss the various solutions, we have come up with to meet their 2030 50% reduction and their 2050 net-zero goals, it is important to understand that there are more solutions than what we suggested. Because of the size of this project, we suggest that Wolfspeed consider breaking the project into smaller parts that a future master's project at the Nicholas School could address. In doing so, we believe that Wolfspeed will gain more benefits as future projects could look at some of our team's suggestions more closely and with greater detail. In addition, Wolfspeed has grown substantially over the last five years and will continue to grow for the foreseeable future. With that in mind, it is important to know that their emissions are likely to increase before they decrease, due to their operational expansion and development of new manufacturing facilities, and that Wolfspeed should be prepared to be aggressive in the implementation of reduction strategies if they still plan to meet their set timeline targets.

With this being said, we have composed our solutions based on our original methodology, the input from our client, interviews with experts, and our own personal expertise to be ranked according to their ease as well as what is most plausible for Wolfspeed to implement right now. The solutions we have identified as the easiest and least timely will provide the greatest information regarding what these solutions are, what they address, how Wolfspeed might implement them and when the anticipated implementation should take place. Moving through the solutions we will share our medium to difficult suggestions as well that still provide an

explanation of how they can be beneficial to meeting Wolfspeed's climate and reduction goals for both 2030 and 2050.

As mentioned previously, these solutions are based on months of research and conversations with experts as well as Wolfspeed's own priorities. However, it is important for us to be transparent as some of the top solutions we are providing might not explicitly have the buy-in from Wolfspeed employees, C-Suite, or Board, but we feel they play an essential role in lowering of emissions and meeting their goals in the necessary timeframe. We anticipate that Wolfspeed will use our suggestions and start conversations and pilot programs to get both their internal and external stakeholders to jump onto the bandwagon or at least consider both the environmental and financial opportunities that these solutions will have on Wolfspeed's goals and targets.

Easiest to Implement and Least Timely Solutions: To be Implemented no Later than 2026:

Implementing Point-Source Abatement Systems

The manufacturing of semiconductors requires the use of various gases categorized as perfluorocompounds (PFCs). PFCs are a type of greenhouse gas that can be particularly harmful to both the environment and human health (Chang & Chang, 2006, 4101-4109). These gases play a role in the cleaning and etching of the wafers that eventually become semiconductors and as of now, there are no alternatives to these gases (Illuzzi & Thewissen, 2010, 201-210). While there is not much to be done about the replacement of these gases as of present, the semiconductor industry recognizes that there needs to be a greater effort in detoxifying these gases before they enter the atmosphere after leaving the manufacturing facility. One of the most successful solutions to controlling these gases has been the installation of abatement systems (Illuzzi & Thewissen, 2010, 201-210).

Abatement systems are an effective tool to reduce the amount of PFC emissions escaping during the manufacturing process of semiconductors. Specifically, abatement systems are beneficial to the etching and cleaning processes of semiconductors (Illuzzi

& Thewissen, 2010, 201-210). The waste from the gases is intercepted in order to detoxify the gas before leaving the fabrication facility (Chang & Chang, 2006, 4101-4109). This process converts the PFCs to non-PFCs, making them “safer” to enter the surrounding environment through reverse osmosis (Tsai et al., 2002, 65-75). While abatement systems may not be the most effective way of controlling these gases, they are one of the most cost-effective and readily available (Tsai et al., 2002, 65-75).

For Wolfspeed, our team recommends that they install point-source abatement systems in both their existing and new facilities. There are multiple manufacturers who produce abatement systems that are specific to the semi-conductor industry (Manesh and Kendrick, 2002). Within the different options, they are either point-of-use abatement or downstream abatement, which differences can be seen in the figures below. The cost of these systems can range greatly from \$25,000 to \$130,000 per unit (Manesh and Kendrick, 2002). This does not include the installation and operating costs of having the abatement systems running and should be considered when deciding which type of abatement system Wolfspeed should use. A further breakdown of costs can be seen in Table 1.

System	Edwards TPU	Litmas Plasma	Hitachi SCDS-2000
Abatement from	Tool Cleaning	Etching	Etching
Number of Inlets	4 ¹	1	4 ¹
Flow Rates, <i>max tested</i> (slpm per inlet)			
CF ₄	2	0.1	0.2
Other PFCs & SF ₆	7	0.2	0.5
N ₂	47	2 ²	48
N ₂ O	1		
SF ₆	25	0.1	0.3
SiH ₄ , B ₂ H ₆ , TMB, PH ₃ , GeH ₄ , WF ₆	0.5		
Total Flow	200	?	200
Concentration, <i>max tested</i> , (vol %)			
PFC	12 %		
SF ₆	10 %	?	10 %
SiH ₄ et al.	2 %	?	0.5 %
Abatement Efficiency (%)			
CF ₄	87-94	92-97	>99.5
Other PFCs & SF ₆	>99.5	>99	>99.5
SiH ₄ , B ₂ H ₆ , TMB, PH ₃ , GeH ₄ , WF ₆	>99.99		
Test Period	6 months	270 hours	6 months
Cost			
Capital (\$)	130K (with water recirculation)	17-27K ⁵ (+2-4K auto water fill)	160K
Installation ³ (\$)	20-50K ⁴	10K	5K
O&M (\$/yr)	8-18K ⁶	>1K	5K-10K ⁷
Dimensions	3' x 2' x 6'	14" x 12" x 6"	~3' x 2' x 6'
Weight (lb)	410	17	
# of Systems Installed	~1000	135	~70

Table 1: Summary of Abatement Comparisons with Costs (Fthenakis, 2001)

While using centralized abatement systems could be a good strategy for the future, there are not many examples of companies using them already and engaging with experts would be needed first. Point-source abatement systems would be a great short-term solution to limit the exposure of toxic PFC emissions from Wolfsped's facilities. This solution would be a good start to measuring the overall effectiveness of how these systems play a role in lowering of their Scope 1 emissions.

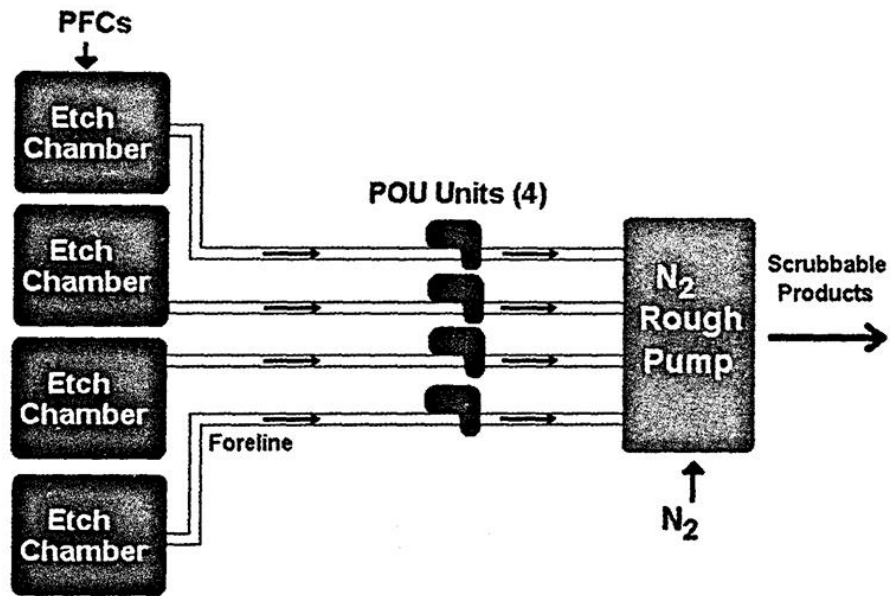


Figure 4: Point of Use Abatement System (Manesh & Kendrick, 2022)

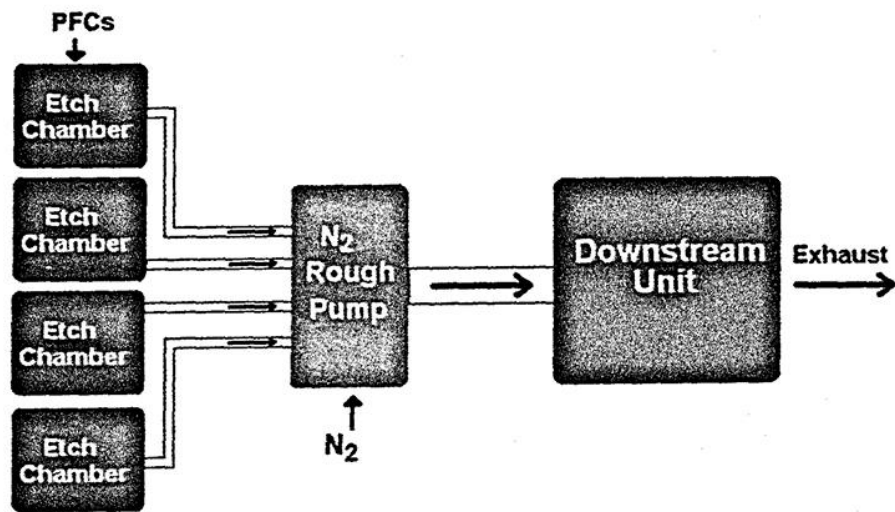


Figure 5: Downstream Abatement System (Manesh & Kendrick, 2022)

Another step we encourage Wolfspeed to take is to engage with EcoPro HN, a technology company that was founded after the Kyoto Protocol, to address environmental issues in business. This company specializes in the management and reduction of chemicals and GHGs into the atmosphere and work environments. They also manufacture centralized abatement systems. EcoPro HN is one of the few who are

working to improve this technology and engaging with them would be beneficial for Wolfspeed to learn more about their process and how it could benefit their emissions. As stated before, with very few companies having centralized abatement systems right now, there would need to be more engagement with companies who are trying to streamline these processes.

However, our team is confident that implementing these systems will be an easy and less timely solution to lowering Wolfspeed's Scope 1 emissions and highly recommend they take actionable steps to put this solution in place prior to 2026.

Linking Executive Compensation to Sustainability and Emission Reduction Performance

As of recent, many large corporations have been tying their executive compensation to both DEI and sustainability or ESG performance. This has grown substantially over the last few years from 66% in 2020 to 73% in 2021 (Spierings, 2022). This is greatly due to the rise in stakeholder and investor interest in both DEI and ESG initiatives as well as mission-driven companies prioritizing meeting these key performance indicators (KPIs). With DEI KPIs really starting the trend, we are now seeing large Fortune 500 corporations tie their carbon footprint and emission reduction goals to executive compensation as well (Spierings, 2022). According to Spierings, we are seeing a variety of companies executing different ways to incorporate sustainability performance into pay for executives that is continuing to evolve. For example, companies are shifting from having ESG targets incorporated in the qualitative individual performance part of their annual incentive plan to including the performance as a larger quantitative "modifier" in their overall financial performance rating (Spierings, 2022).

Wolfspeed has already implemented tying DEI KPIs to their executive compensation, and they could follow the same steps they took to accomplish this so we feel it is an easy solution for them to implement into their broader business operations. While there can be some concerns surrounding tying sustainability KPIs to executive pay, our team feels the pros outweigh the cons.

We believe there to be such an increase in companies tying executive pay to sustainability KPIs because most companies are now seeing sustainability, climate change and ESG as a top priority for the future. Implementing this solution is a great way for the company to stand by the emission reduction and climate commitments they have established. For this solution to be successful there are steps that Wolfspeed must take to make sure it is meaningful towards their goals and targets. It is crucial to have a strong “business case” for this solution and have goals that are specific and require hard work (Spierings, 2022).

While it may take time for this solution to completely fall into place, we do believe it can be accomplished in the next three years for Wolfspeed. As with DEI goals, it is essential that Wolfspeed validates its reduction goals before incorporating them into compensation plans for executives and even broader employees.

For Wolfspeed to successfully implement this solution, the following steps should be taken according to Spierings research:

- Highlighting sustainability and climate goals that are auditable, of material interest and strong
- Evaluating whether any of Wolfspeed’s competitors or other peers are doing this and if it is informative
- Making a decision to have KPIs “absolute or relative to the market” and either quantitative or qualitative
- Determining exactly whose compensation falls under the set sustainability and climate or other ESG goals
- Understanding the timing implementing this solution will take and if the set goals are set for the long-term or on a more annual incentive strategy
- Ensuring that this performance metrics fit into the larger culture of Wolfspeed
- Receiving feedback and reactions from all stakeholders involved
- Continuously looking back at sustainability and climate goals to make sure the KPIs are still effective and up-to-date
- Making the case to investors on why changing the compensation packages of the company will have an overall benefit on Wolfspeed’s financial, operational and sustainability goals and the risks that may be associated with it

- Educating employees on why their compensation is now being tied to these sustainability KPIs if it is not already obvious

Greenhouse Gas Protocol Survey and Feedback

The Greenhouse Gas Protocol Standard is a mostly universal tool in the measurement of a company's greenhouse gas (GHG) emissions of all 3 Scopes. The protocol provides guidance on how these Scopes should be calculated in a GHG inventory and what emission factors should be used in calculations of different GHG categories. The most general standard, the GHG Protocol Corporate Standard, is what most corporations who calculate their GHG emissions use, including Wolfspeed.

Because this standard is used by so many companies and plays such an essential role in company's emission reduction and climate goals, the GHG protocol is now seeking feedback from their stakeholders on how the standards can be improved. This includes the improvement of the Corporate Standard, Scope 2 guidance, Corporate Value Chain (Scope 3) and Scope 3 Calculation Guidance and market-based accounting approaches.

While this solution does not have a direct effect on the lowering of Wolfspeed's emissions, we feel it is a crucial step in adjusting the measurement process, which is an important part of understanding your total emissions, and the strategies to reduce them and meet future goals. In addition, this will add greater value to meet their goals.

Wolfspeed can answer all 4 surveys or choose which ones might be the most relevant for them. From reviewing their own GHG inventory, we feel this would be particularly helpful for the measurement of their Scope 3 emissions. Wolfspeed does do a good job of measuring its emissions, however, they have struggled with the accuracy and complete understanding of all its Scope 3 emission categories and accurately measuring each one.

The Scope 3 survey consists of a total of 29 relevant questions with many asking companies to rate the current standard and calculation guidance, but also leaving room

for short-answer responses on what methods should be changed completely, removed, added, or improved. Supplemental to the survey, there is also an opportunity to submit a proposal for any updates that a company might want to suggest to the GHG protocol. Our team is confident that this is not only a great way for Wolfspeed to provide its own feedback but also collaborate with other stakeholders to inform the GHG protocol on how the measurement and guidance process can be improved to successfully meet various emission reduction, science-based targets, and net-zero goals.

Value Stream Engagement and Synergy

A value stream engagement strategy will help companies engage and communicate climate commitments and initiatives throughout their value stream. The point of value stream strategy is to not only communicate your climate goals but also to push suppliers and users to create similar goals such that the entire value stream works together to accomplish their individual goals.

How you engage with your suppliers will vary based on where they are in their sustainability journey. For those that have not begun to consider their environmental impact, it will be important for them to start measuring their emissions, and shortly after, report those emissions to CDP. For companies that are already reporting on their environmental footprint, push them to make climate commitments of their own that align with your targets. As a consumer, Wolfspeed has the leverage to ask this of their suppliers. Once climate commitments have been established throughout the value chain, suppliers and consumers alike can work together to develop products and services that reduce their own Scope 1 and 2 emissions and, in turn, reduce each other's Scope 3 emissions.

Wolfspeed should begin to communicate its climate goals with its value chain and should request that its suppliers create similar goals or risk their business being re-evaluated. Wolfspeed should begin this communication immediately as it will be delayed in not only finding the proper contact at the supplier but also seeing progress from the supplier. By expressing to suppliers that Wolfspeed is continuing to invest in a low-emission value chain, Wolfspeed, and its suppliers can look for opportunities to update processes or

replace tools for lower-emitting counterparts. By communicating and utilizing a results-driven approach, Wolfspeed should work with suppliers to identify improvements to the semiconductor manufacturing process. One example of this is to work with Applied Materials, one of the world's largest semiconductor supply chain companies that manufactures much of the equipment used in the fab. Being listed as one of Barron's most sustainable companies in 2022 and having spoken on a panel focused on decarbonizing the semiconductor industry at GreenBiz23, Applied Materials is eager to collaborate with companies to decarbonize the semiconductor value chain.

Electric Purchasing Policy

An electric purchasing policy is a policy that prioritizes the purchasing of vehicles, tools, or other machinery that can be powered by electricity rather than a fuel that requires the burning of greenhouse gasses.

When a good reaches its end of life, the person responsible for purchasing should identify if there is an electric version of the good that can act as its replacement in the operation. If there are headwinds to the adoption of a new electric good, consider whether those headwinds stem from an internal process or external limitation. For internal headwinds, look for opportunities to adjust your process and make the good work. For external limitations (say the battery life, range, or power of the good), work with the manufacturer of the good to express what is holding your business back from adoption of their product. This information can be crucial to manufacturers and could form the beginning of a mutually beneficial partnership.

While an electric purchasing policy can be used to instantly replace traditional machinery and vehicles, it is more realistic, and perhaps better, to wait until the good has reached the end of its productive life and replace it with its electric counterpart. This will also help to stagger the capital investment required and vary the timeline for implementation, which can present opportunities for learnings to be applied to the next purchase. In the case of goods with a longer expected lifetime, one should consider selling the item while it is still productive. In consideration of selling a good before the end of its productive life, it would be wise to consider if the good has surpassed a point in which it tends to lose

considerable value, such as when a vehicle reaches 100K miles. If such is the case, using the good until its absolute end of life may be the best path forward.

Shifting to a good (tool, vehicle, machinery, etc) powered by electricity will improve the emissions profile of the good, it is important to recall that there will be some residual emissions as the grid is still mostly powered by fossil fuels. While the reliance on the grid for power may only have a small decarbonization impact initially, we should expect that impact to grow as the grid decarbonizes over the next several decades.

Wolfspeed can look to replace its small fleet of vehicles with electric vehicles. More specifically, Wolfspeed could look to replace its vans with Ford E-Transit All-Electric Van and replace pickups with the Ford F-150 Lightning or the Chevy Silverado EV. Wolfspeed can also look to replace industrial heaters and chillers with electric alternatives. Since some electric alternatives may be more expensive than traditional goods, it is important to remember that the purchase of electric goods shows employees that sustainability and decarbonization is a top priority for Wolfspeed. Many employees may not be familiar with the emissions hotspots at Wolfspeed's facilities, but they are likely to know that an electric vehicle is better for the environment than a traditional internal combustion engine. By following up the message that sustainability is a top priority with an investment in a more carbon friendly good that employees can physically see and comprehend, Wolfspeed can build a stronger culture around sustainability that engages their employees to find decarbonization solutions throughout the manufacturing process.

Internal Carbon Price

An internal carbon price places a monetary value on greenhouse gas emissions (Ahluwalia, n.d.). Most companies use internal carbon to drive low-carbon investment, energy efficiency, and change internal behaviors (CDP, 2021). There are various types of carbon prices with the most popular being a shadow price and an internal tax/fee. A shadow price is a theoretical cost or amount that an organization does not charge, but

rather is used in analysis for varying projects or investments (TCFD, 2021). An internal tax/fee is a carbon price charged to a specific activity, product line, or business group in which the value of the tax is paid by the emitting business group or product line.

The use of an internal carbon price can be used for analysis or to fund sustainability projects. In cases where money is transferred, the dollars are typically used to fund a renewable energy or energy efficiency project. In this way, the money is reinvested back into the business to reduce emissions and potentially energy cost savings. When money is not transferred, companies may still use the theoretical amount as a budget for a project. The carbon price can also be used for analysis when making purchasing decisions. For example, when comparing the cost of an electric vehicle versus one with an internal combustion engine, one should include the cost of carbon and estimated emissions over each vehicle's lifetime as part of identifying each vehicle's total cost of operation.

The carbon price used by companies varies considerably, but the median internal price is \$25 per metric tonne of CO₂e (CDP, 2021). The value given to an internal carbon price is influenced by regulation, climate goals, the carbon budget, and the Scope to which the value is applied to. Per Microsoft's CDP Climate Change response, Microsoft uses a \$15 value per metric tonne of CO₂e from their Scope 1 and 2 emissions while applying a \$5 value to Scope 3 emissions (apart from business travel which is valued at \$15).

To meet the increased demand for Silicon Carbide semiconductors, Wolfspeed has focused its capital on growing to meet demand. While this is good for business, it has meant that climate driven investments have fallen in priority. To raise funding for future projects, Wolfspeed should implement an internal carbon price that can be used for initiatives in this document and beyond. As the idea of a carbon price has seemingly been unwelcomed during an intense growth period, Wolfspeed should start with a low carbon price that ramps up annually and may choose to limit the price to Scopes of their inventory. For example, Wolfspeed may begin with a \$10 carbon price for Scope 1 and 2 and increase it by \$5 annually. After doing some brief calculations our team found that setting a carbon price of just \$10 for Scopes 1 and 2 would bring Wolfspeed \$4.5 million to be invested in sustainability initiatives. If Wolfspeed had a \$25 carbon price for

Scopes 1 and 2 this would bring in \$11.4 million. It is important to remember that this does not include Scope 3, which could bring in a considerably greater amount than just Scopes 1 and 2. Considering Wolfspeed's growth in Germany and the added regulations that come with being in the European Union, Wolfspeed should consider a significantly higher price for the emissions from its new German facility.

Mid-Term Solutions to meet 50% Reduction Goals: To be Implemented no Later than 2030:

Verified Science-Based Targets by Science Based Target Initiative (SBTi)

Science-based targets are set goals that a company sets to reduce their GHG emissions, avoiding future negative impacts of climate change and the opportunity for your business to continue to grow. According to SBTi, targets are "science-based" if they align directly with what climate science has considered necessary to meet the goals of the Paris Agreement, limiting the warming of the earth below 2 degrees Celsius above pre-industrial levels and making sure the global warming does not exceed 1.5 degrees (*How It Works*, n.d.).

Wolfspeed has aimed to set science-based targets, however, they have not had these targets verified by SBTi. Our team feels this is an essential step they must take to meet their goals on time. However, they will need to fully understand all three of their emission scopes to have them verified by SBTi. This means that they should use this time to come up with a science-based target for their Scope 3 emissions by taking the time to collect the necessary data for their relevant Scope 3 categories and accurately measure their emissions in this area. Once they do this, there are five steps they need to complete. The steps consist of the following and are based on the advice from SBTi:

- **Commit:** send a letter of intent to set a published science-based target
- **Develop:** work on these emission reduction targets based on and in conjunction with the SBTi criteria
- **Submit:** present targets to SBTi for them to validate

- **Communicate:** publish and announce targets to all the company's relevant stakeholders
- **Disclose:** continue to report company emissions and track the progress of meeting the reduction targets on a yearly basis

Wolfspeed should not have an issue with joining the SBTi and there are many benefits to being part of this initiative including saving money, "future-proofing company growth," gains better traction with investors, making room for greater innovation and allows Wolfspeed to be a stronger competitor and showing customers that they care about sustainability and protecting the global climate. Additionally, by joining SBTi, Wolfspeed will be able to gain further insight on how to reduce their emissions to meet their science-based targets they have established. SBTi will give Wolfspeed a brand boost and will help them meet their reduction goals in the timeframe they have made clear.

Virtual Power Purchase Agreements (VPPAs) and/or Utility Solar

VPPAs can be a great way to lower existing emissions. Like a power purchase agreement (PPA), in a VPPA the company buyer does not own and is not responsible for the physical electrons the project generates (Kansal, n.d.). This means that a VPPA is only a financial transaction, exchanging a fixed-price cash flow for a variable-priced cash flow and renewable energy certificates (Kansal, n.d.). For this reason, a company will still need to complete its electricity load through more traditional means, which means that the company still has the same relationship with its current utility provider.

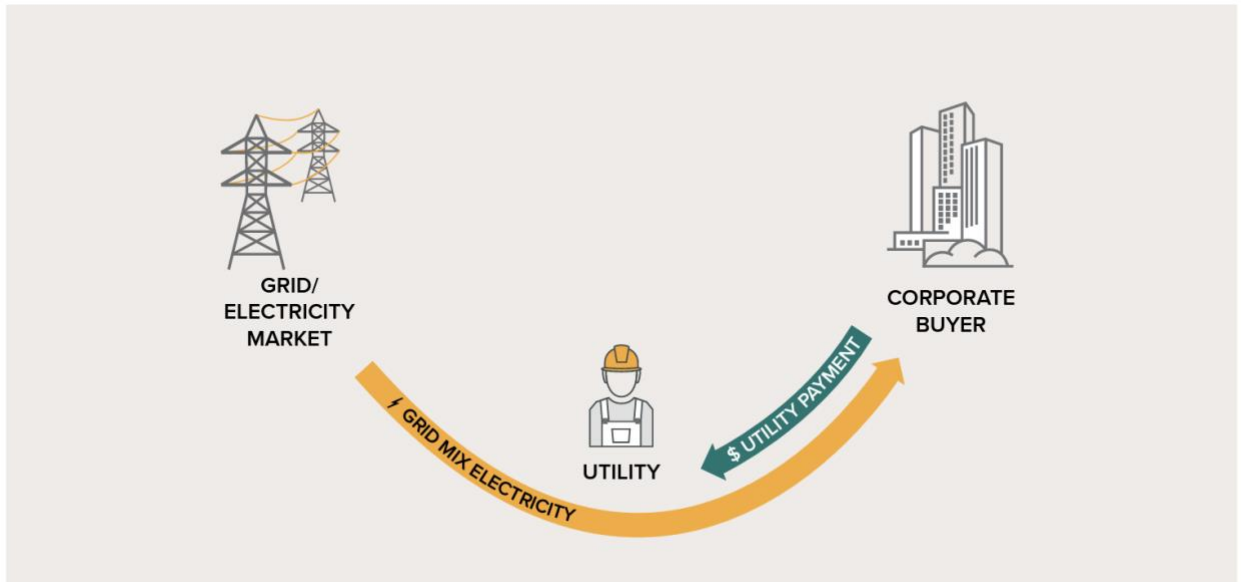


Figure 6: VPPA relationship with utility (Kansal, n.d.)

A VPPA and a PPA are both popular contractual agreements used today in the procurement of renewable energy sources. According to RMI, the reason for their popularity is that they allow companies to show a “direct link between their actions and new renewable energy generating capacity” (Kansal, n.d.). A VPPA is a great way to meet sustainability goals with a small number of contractual deals.

We strongly believe Wolfspeed should consider entering into a VPPA contract. While PPAs are similar, the reason we do not recommend them is that the state of North Carolina is currently run by the monopolized utility, Duke Energy, which do not currently allow many of these types of agreements. However, because a VPPA is not physical, this could be an alternative solution. With just one VPPA contract, Wolfspeed could theoretically meet all of its emission reduction goals for specific emission Scopes. Additionally, Wolfspeed could participate in utility solar projects in areas where these projects are easily accessible.

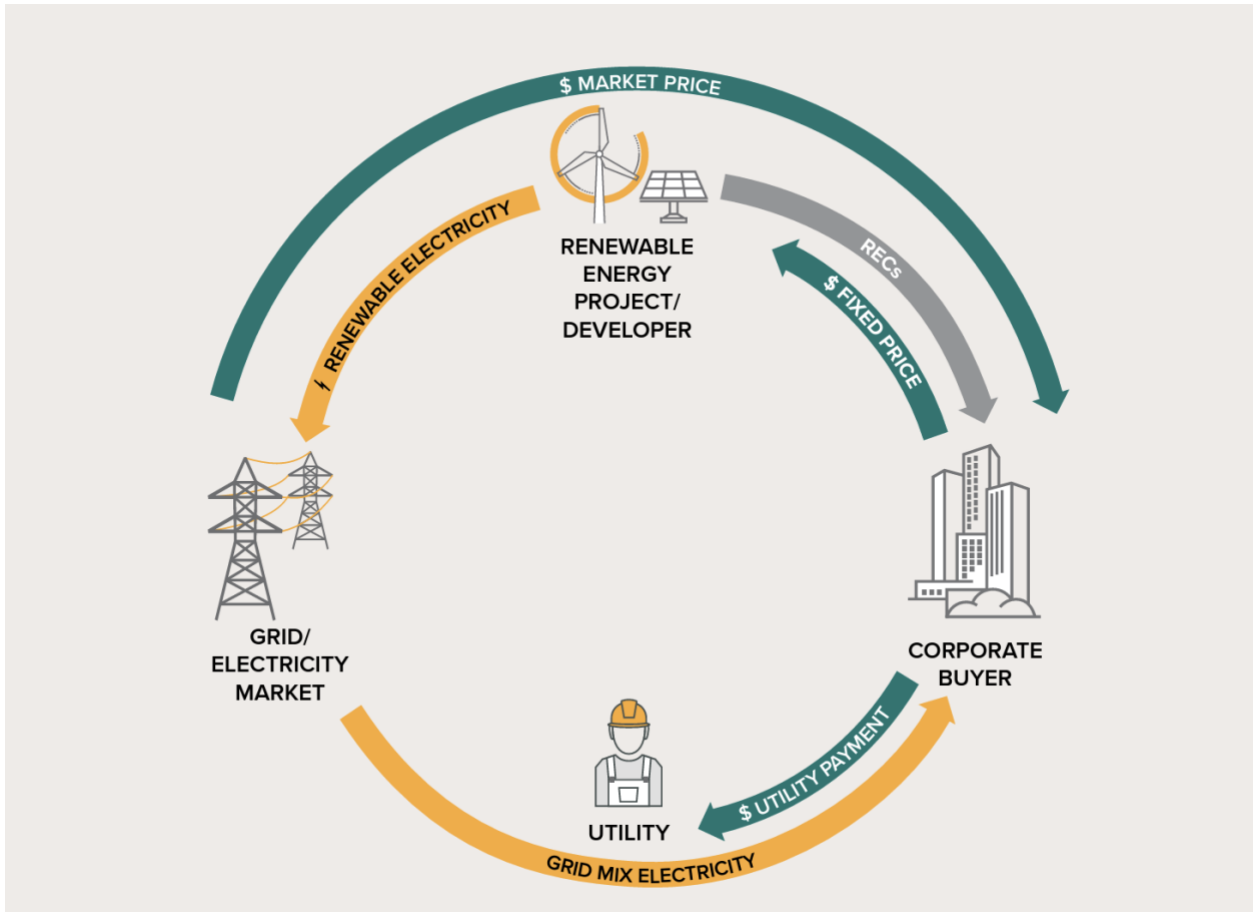


Figure 7: How a VPPA Works with Wolfspeed as Corporate Buyer (Kansal, n.d.)

If Wolfspeed wants to participate in a VPPA they can do so in any “deregulated market in the United States,” while continuing to pay their normal utility bill to Duke Energy. From here, the contract would be an agreement between Wolfspeed and a renewable energy project or developer and pay a fixed price for whatever electricity is produced from this project. In return, Wolfspeed will receive the RECs for all the clean energy that the renewable energy project makes. Wolfspeed should also be aware that these RECs can be traded if they want to do so but if they choose to “retire” them, they can go directly toward Wolfspeed’s sustainability and reduction goals. RMI states that bundled RECs are associated with the purchase of electricity and unbundled RECs are traded separately from the generation of electricity (Kansal, n.d.). Under this contract, there is a “variable market price” that goes from the renewable energy project to Wolfspeed, meaning Wolfspeed would have a monthly or quarterly settlement to take care of to the project. This price is dependent on the fixed price and the actual market price the project has (Kansal, n.d.).

Wolfspeed has the ability to implement VPPAs at their North Carolina facilities and can even engage in PPAs in facilities in other states, such as New York to install renewable energy directly on their site. Duke Energy does engage in VPPAs and it would be a good idea for Wolfspeed to engage with them to understand how this process would look for their North Carolina plants.

Policy Advocacy for Decarbonization and Renewable Projects

While policy advocacy can seem like a huge responsibility to take on, it is an important step for a company who is looking to decarbonize and have more renewable projects. Policy advocacy is one of the ways companies from similar industries can join forces to put greater pressure on state and federal governments for more sustainable projects and the decarbonization of the grid.

Our team thinks Wolfspeed could benefit greatly from doing this. With their headquarters being in North Carolina, there is a lack of renewable energy projects and still a heavy reliance on traditional forms of electricity such as oil and gas. As such, there are not as many opportunities for reducing emissions effectively and efficiently for Wolfspeed's operations here.

According to the World Resources Institute, while there have been many companies moving towards more sustainable goals, that alone will not be enough for the future. There must be changes in public policy to meet the commitments of the Paris Agreement (Meyer, 2021). It is crucial for companies like Wolfspeed to incorporate climate policy into their overall sustainability and reduction strategies. WRI makes a great case for how to get started using the following steps:

- **Send out a climate memo:** This can be addressed to the C-Suite. Try to connect Wolfspeed's sustainability goals with its existing lobbying priorities and show how various teams could work together to make this a reality.

- **Include the climate ask:** During an annual meeting with Wolfspeed's trade association, ask questions about how they can best represent Wolfspeed's climate interests and make it clear that climate policy is a priority for Wolfspeed.
- **Tell Wolfspeed's climate stories:** It is important for Wolfspeed to show stakeholders how engaging in policy action or not will affect Wolfspeed's climate and reduction goals. Show them how this connects directly to what Wolfspeed's investors are interested in for the future as well as all other existing stakeholders.

By engaging in climate policy, Wolfspeed will not only show the importance of meeting its own goals but will be a leader in their industry, working hard to promote cleaner and greener business practices that will continue to benefit them.

Energy Audit and Inspection

For companies that have a high number of inputs in the manufacturing process, it can be difficult to ensure all inputs are operating as intended. A leak from an input can lead to higher usage which can result in greater spending and a larger impact on the environment. To prevent these use costs and emissions from occurring, it is important to conduct an occasional energy audit, ideally to ISO 11011:2013 standard.

For Wolfspeed, an energy audit and inspection could mean tremendous cost savings and the identification of abatement opportunities. Given the age and complexity of Wolfspeed's Durham facility, there are opportunities abound to discover leaks or inefficiencies in the flow of liquids and gasses throughout the facility. The audit is likely to not only discover leaks but also likely to find opportunities to improve efficiency using new technology or mitigate forms of exhaust using abatement technology. Wolfspeed has done well to audit its facilities in the past and plans for additional audit soon indicate that they continue to find value in auditing their facilities.

Limit Waste

In any manufacturing process, it is important to maximize the rate at which a good successfully completes the manufacturing process. This is especially true in the case of

the semiconductor manufacturing process as it requires intense use of resources and holds a high monetary value upon completion.

For Wolfspeed's Durham facility, this can be a challenge. Much of the technology can be updated, the process still requires a large quantity of human touch, and the flow through which the wafers move through the facility can be improved to reduce the potential for human error. While Wolfspeed is still working to meet surging demand, they should look for opportunities to improve the way the wafer moves through the facility and modernize machinery to reduce the amount of human touch and, therefore, potential error. The manufacturing of a semiconductor demands such high resource use that every measure should be taken to reduce the amount of waste and improve yield.

Long-Term Solutions to meet Net-Zero Goals: To be Implemented no Later than 2045:

Gas and Chemical Replacements

As we move closer to 2050, it is important to consider what replacements are currently and will be available for gas and chemicals used in the manufacturing facility and its processes. With technology only advancing, the semiconductor industry will continue to manufacture based on the growing demand for more efficient and innovative chips to be used in many products. According to McKinsey, getting the semiconductor industry to net-zero will require a lot of action and more so than other industries that have published net-zero goals (*The Path to Net Zero: Semiconductor Sustainability, 2022*).

For Wolfspeed and other semiconductor manufacturing companies, most of their emissions from the semiconductor fabrication process are Scope 1 process gases, such as PFCs, and Scope 2 electricity (*The Path to Net Zero: Semiconductor Sustainability, 2022*). We already know that Wolfspeed's emissions are expected to grow before they decline, with the development of new manufacturing facilities and the increased demand from their customers.

Based on our research, we would recommend considering replacing heat transfer fluid (HTF) with lower global warming potential options (GWP) (*The Path to Net Zero: Semiconductor Sustainability, 2022*). Moreover, Wolfspeed should consider replacing its current fuel with cleaner options like hydrogen gas or biomass fuel (*The Path to Net Zero: Semiconductor Sustainability, 2022*). By implementing both solutions, Wolfspeed would see a decrease in its Scope 1 emissions. It will be important for Wolfspeed to stay up to date with existing innovative technologies for both the recycling and reuse of gases in their fabrication facilities (*The Path to Net Zero: Semiconductor Sustainability, 2022*).

Corporate Venture Capital

Corporate venture capital is a relatively new phenomenon in which corporations use capital to invest in ambitious startups that can play a pivotal role in their industry. Rather than rely on their own internal research and development, corporate venture capital allows corporations to invest in startups that can change the way they do business. By investing in these startups early on, corporations can also gain an edge over their competitors. For some companies, corporate venture capital has been focused on decarbonization. For example, United Airlines Ventures (the corporate venture capital arm of United Airlines) has made numerous investments in electric and hydrogen airplanes to decarbonize their short-haul fleet (United Airlines, n.d.). They have also invested in sustainable aviation fuel for routes that are currently too long to convert to electric.

Wolfspeed can utilize corporate venture capital to invest in a low-carbon future and incentivize entrepreneurs to focus their efforts on decarbonizing the semiconductor industry. To begin, Wolfspeed should identify hotspots in its value chain and then publicly voice its desire to invest in a decarbonized solution to the identified hotspot. For example, Wolfspeed may look towards new materials that further improve the use phase efficiency of the semiconductor or may turn towards investing in low carbon transportation for the use of its supply chain.

One of the largest challenges of corporate venture capital is funding. To properly invest in the future, large amounts of money are needed, as well as an understanding that venture capital is a high risk, high reward use of capital. Further, it should be assumed

that even successful investments will not provide scalable solutions for years to decades. Wolfspeed is currently, and understandably so, utilizing its capital to meet demand. As the market settles, Wolfspeed can look to corporate venture capital as a tool to fund the innovation to reach its long-term emissions reduction goals.

Limitations

It is important for us to note some of the limitations we faced throughout this project. As mentioned previously, Wolfspeed wants to write a CTAP that includes all three emission Scopes, however, they first need to make sure they have an accurate representation of their emissions. While their Scope 1 and Scope 2 emissions are solidified, they need to collect more data on their relevant Scope 3 categories and make accurate science-based targets from this data and GHG measurement. We recognize that Wolfspeed is only starting to look more closely at their Scope 3 emissions and while our team tries to provide some strategies to address this, we feel Scope 3 is outside of the scope of this project.

In addition, it is important to recognize that for Wolfspeed to meet their emission goals, they need to ensure they have the support of the necessary people internally. While our team can provide strategies we know have had proven success for other companies, it is up to Wolfspeed to take these strategies and decide what will work best for them and their business goals and operations.

Opportunities for Future Research

We mention throughout our project that there still is work to be done and always room for improvement in Wolfspeed's emission reduction. There are many changes taking place in the corporate sustainability space and with requirements needed from the SEC, investors, and more.

With regards to their Scope 3 emissions, we encourage Wolfspeed to take time to research and fully understand what will be required by the SEC in terms of reporting Scope 3 emissions.

While these rules are still fairly new, it will take time for them to be streamlined into standard reporting practices. In the mean time, it would be advantageous for Wolfspeed to invest their resources into collecting the appropriate data for their relevant Scope 3 categories. Additionally, understanding the expectations of their investors will be important for improving their sustainability initiatives.

Conclusion

As stated throughout our report, we feel Wolfspeed has the capacity to achieve its stated emission reduction and climate goals. While it will be challenging given their current operational growth, we are confident that the solutions we have provided will be helpful in making strides to achieving these targets. We feel that both the recommendations on how to build a CTAP as well as our actionable solutions to meet their published reduction targets will give Wolfspeed the base to get the ball rolling as soon as possible.

Looking to the future, we anticipate that Wolfspeed will need to pay particular attention to its Scope 3 emission categories. As mentioned, we feel it would be beneficial to Wolfspeed to consider teaming up with another Duke master's Project group that will focus solely on the reduction strategies related to their Scope 3 emissions. We also encourage Wolfspeed to stay up to date with how the reporting of Scope 3 is going to evolve.

More importantly, Wolfspeed produces goods that help other industries lower their emissions. We think it could be important to see how many emissions they have helped reduce for other industries through the direct use of their products. In doing so, we think Wolfspeed may have an advantage to continue growing but potentially offsetting their emissions by the countless amount they have helped their customers reduce. Wolfspeed should be asking themselves if this is making a dent in their total environmental and carbon footprint. We suspect that this probably makes a huge difference and should be highly considered when evaluating their emission reduction goals moving forward. This type of emission reductions does not fall into the traditional three Scopes most are familiar with but is part of a new category titled Scope 4 or avoided carbon emissions. These are emissions reduced outside the boundaries of their

product lifecycle but result from the direct use of that product (*“Scope 4” Is Here - Avoided Emissions Becomes a New Way of Measuring Climate Impact*, n.d.).

Meeting these climate and reduction goals are hard work and we have seen how challenging this is through our research of many companies and industries. While the road ahead for Wolfspeed requires a lot of collaborative work internally and externally, we have faith that Wolfspeed will continue to take steps in the right direction to meet its goals and transform its business operations to be even more sustainable. Wolfspeed understands the urgency of these targets and we are confident they care deeply about making a wider impact within their operations and with all the stakeholders they work alongside. Our team is hopeful that they will learn from their existing practices and what they can do in the future to not only be more sustainable but be a leader in sustainability in the semiconductor industry.

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