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Corporate Social Responsibility in the Information Technology Industry

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Corporate Social Responsibility in the Information Technology Industry

by

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List of Acronyms and Abbreviations

EPA	Environmental Protection Agency (United States)
CBSM	Community Based Social Marketing
CCA	Community Choice Aggregate
CSR	Corporate Social Responsibility
FTE	Full Time Equivalency
LEED	Leadership in Energy and Environmental Design
SEC	Securities and Exchange Commission
WARM	Waste Reduction Model

Abstract

Information technology companies contribute to greenhouse gas emissions via data servers, office administrative operations, and manufacturing of hardware components. Corporate Social Responsibility programs are a voluntary method of tracking and reducing negative environmental impacts. The 2019 Corporate Social Responsibility data from four Bay Area (California, USA) information technology companies (Adobe, Cisco, Salesforce, and Nvidia) all listed in sustainable index funds were compared to determine best reporting standards. The data analysis also allowed for research into how carbon emissions are categorized and reported on, and which emissions companies pay attention to through Corporate Social Responsibility projects. The physical ownership responsibility for CO_2 emissions are titled Scope 1 (company's own emissions), Scope 2 (energy used in operations), and Scope 3 (suppliers and stakeholders' emissions). Most of the company's emissions come from Scope 3 operations, but most of the Corporate Social Responsibility projects address emissions in Scope 1. Without industrywide key performance indicators or standard reporting frameworks, sustainable actions cannot be easily compared. Adding regulatory requirements, such as those proposed by US Securities and Exchange Commission, will improve corporate CO_2 reporting standardization and transparency, allowing for easier comparisons and highlighting scalable environmental improvements. Companies in the information technology industry can reduce their carbon emissions by improving energy efficiency at data centers, implementing sustainable software design, and prolonging the lifespan of hardware components by making products modular and repairable.

1.0 Introduction

Information technology corporations play an important role in mitigating climate change by reducing operational global greenhouse gas emissions. The global greenhouse gas emissions from the technology industry are estimated at 730 million metric tons of CO_2, roughly 2.3% of global greenhouse gas emissions (Malmodin and Lundén, 2018). Greenhouse gasses, such as carbon dioxide, are emitted into the atmosphere through normal business operations. In the United States, greenhouse gas reduction targets require the cooperation of businesses, but it is up to the business itself to figure out how to reduce its carbon footprint and by how much. Government agencies can enforce environmental regulatory requirements on businesses, and businesses can create and enforce personalized internal environmental policies and goals. Voluntary environmental business objectives are key to reach goals set by the United States and international coalitions, such as the Paris Agreement and United Nations Sustainable Development Goals, because government action and enforcement is lacking.

1.1 Greenhouse Gas and Carbon Dioxide

Carbon dioxide, CO_2, is a potent greenhouse gas contributing to global climate change (Pörtner et al., 2022). Businesses in the information technology sector rely on energy not only to keep the lights on in office buildings, but to run and maintain large computer server farms. These large computer server buildings are especially important for software-only businesses that do not sell physical products. The products are online and offline services software products, but even these digital products have a carbon footprint. Through this lens, the industry most closely associated with information technology is the energy industry.

Information technology companies create and sell virtual products, software, and web hosting services alongside conventional physical products. Virtual products and software have a measurable carbon footprint. Computer servers and data centers host and run the software, and office spaces filled with commuting employees design and create the software.

1.2 Software and Hardware Carbon Emissions

Companies in the information technology industry use computers to design software and hardware solutions to problems. Some companies, such as Cisco, design software products (e.g., computer and computer network operating systems) and hardware products (e.g., telecommunications and conferencing equipment). Other technology companies, such as electronic document editing company Adobe, only have software products (e.g., Photoshop).

When new software and hardware products are developed, energy efficiency is considered a lower priority compared to reliability and security (Calero et al., 2019). However, pressure from consumers, employees, customers, shareholders, governments, and other stakeholders have pushed more technology companies to include sustainability into the core business model.

Because hardware products are tangible and have a more apparent supply chain and environmental impact than software products, hardware centered companies and products get more sustainability attention and improvement. The two software only companies in this study demonstrate how sustainable actions can easily be woven into business process improvements for the company and for the environment.

Software does have a carbon footprint, and software developing companies should focus on increasing the energy efficiency of these products to reduce those carbon emissions. For example, a single Google Search emits 0.2 grams of CO_2. The carbon emissions increase to 7.0 grams of CO_2 when the associated data center is taken into account (Hölzle, 2009). By taking sustainability into account when designing software, information technology companies can contribute towards CSR goals.

1.3 Corporate Social Responsibility Programs

One voluntary method of environmental action is Corporate Social Responsibility, or CSR, programs. CSR programs can take a variety of forms from a complete overhaul of a company's supply chain to sourcing local ingredients served at corporate office cafeterias. The variety, variability, and lack of regulatory oversight or enforcement surrounding CSR programs make

them hard to summarize and compare between organizations (Córdova Román et al., 2021). The focus of this study is four Bay Area information technology companies and how CSR programs impact environmental outcomes from a carbon emissions standpoint. CSR programs generally include all of the companies' environmental programs and goals, not just those directly tied to carbon emissions, and because of this they are not often included in broader conversations about greenhouse gas emissions reductions. A company's singular stated goal of carbon reduction is a key element of the CSR report, but other aspects of the report also tie into carbon emissions reductions strategies.

Corporate Social Responsibility (CSR) programs aim to voluntarily improve the sustainability of a company from within the organization. The programs can include internal and external stakeholders, be based on government policies and industry tools, and can have varying levels of transparency and actual effectiveness in reducing carbon emissions (Porter, 2008). Many definitions of CSR focus on the voluntary nature of the programs (Mackey et al., 2007) rather than those prescribed by public policy requirements or contractual obligations. Early CSR programs focused on philanthropy and charitable giving, but now a greater focus is placed on business process improvements and employee programs (Schons and Steinmeier, 2016). For-profit and publicly traded companies have a fiduciary responsibility to shareholders to make a profit and maintain or increase the share price. For CSR programs to work within that business context, the programs must have a negligible or positive impact on the firm's finances. This financial component of a sustainable program has been called the Triple Bottom Line or People Planet Profit model (Elkington, 1994; Elkington, 2006). This model incorporates multiple stakeholders (e.g., employees, customers), financial implications, and environmental sustainability into the project or program. Charitable giving and employee volunteer hours can exist separately from the Triple Bottom Line fiduciary responsibility model; however, charitable giving has co-benefits that can lead to financial gains for an organization.

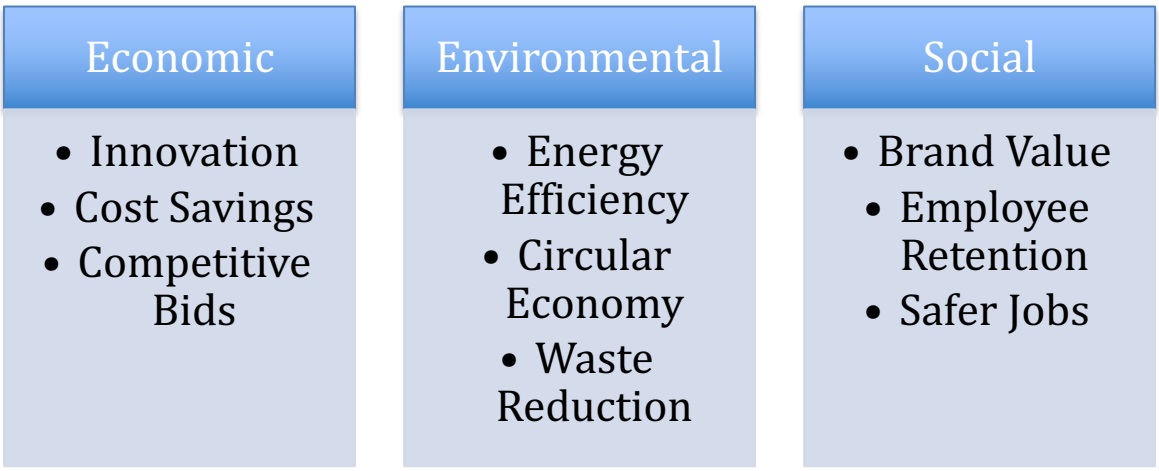


Figure 1: A chart showing example benefits of CSR programs in the three main categories of Economic, Environmental, and Social.

This study selected company CSR reports based on inclusion in financial markets designed for selecting sustainable business practices. Financial institutions have an increasingly important role in corporate sustainability activities because they are one of the few regulatory bodies with the ability to enact and enforce across-the-board policies. Publicly traded companies must comply with many regulations to be listed on stock exchanges. The compliance documents are made public and available to shareholders and the general public.

The Securities and Exchange Commission has shown interest in enacting a first of its kind greenhouse gas emissions disclosure and climate risk assessment requirement in the United States (Gura and Nam, 2022). Climate risk assessments will (1) ask companies to quantify and account for greenhouse gas emissions, (2) increase transparency for the public, and (3) create a uniform standard requirement for greenhouse gas emissions reporting. The greenhouse gas emissions disclosure will be reported in equivalent units of CO_2 (CO_2e), and companies will need to report emissions created directly by the company and those emitted by supply chain manufacturers.

1.4 Research Questions

This study summarizes the CSR reports of four companies that voluntarily disclose greenhouse gas emissions, though each company reports the information in its own way. With the report information normalized by company size (annual revenue, number of employees) and converted into equivalent tons of CO_2 (CO_2e), the four companies can be compared against each other. Which utilities should companies focus CSR efforts on to reduce carbon emissions for hardware and software technology companies, and are there generalizations that can be drawn from the breakdown of Scope 1-3 emissions?

The sections in this paper will feature research in the field of CSR, information technology sustainability challenges and opportunities for carbon emissions, and an original analysis of four different companies CSR reports with a methods section.

The next section describes the methods used in selecting and analyzing the four companies reviewed in this paper. Using four selected companies, I will detail one CSR report from each, and using those findings extrapolate key performance indicators for the information technology industry. What is the carbon intensity of each of these four information technology companies, in terms of revenue and number of employees? Are the companies making physical products more carbon intensive than those making digital products? I hypothesize that the companies making physical products (i.e., Cisco and Nvidia) will be more carbon intensive than the companies only making software (i.e., Salesforce and Adobe).

The literature review section will detail several key topics used in this research paper to answer more questions. The literature review includes the CSR reports themselves and their frameworks, carbon emissions and accounting in CSR reports, types and impacts of different energy sources, computer data centers, and two methods of sustainability project implementation.

Using the information from the literature review, the next section on CSR report analysis will ask questions about carbon emissions and types of sustainability programs. What type of corporate sustainability programs have the greatest carbon reduction potential? I hypothesize that the sustainability CSR programs with the greatest carbon reduction potential are those aimed at

business process improvements (i.e., supply chain, manufacturing, energy) rather than those aimed at changing employee behavior. Are the corporate sustainability programs primarily targeting improving business processes or changing employee behavior through community based social marketing (CBSM)? Are the corporate sustainability programs addressing Scope 1, 2, or 3 emissions? I hypothesize that Scope 3 emissions will be the largest segment of emissions for companies making physical products (i.e., Cisco and Nvidia), while Scope 2 emissions will be the largest segment of emissions for companies only making software (i.e., Salesforce and Adobe).

Lastly, in the management recommendations, I will use the CSR report analysis to answer an overall question: what external policies or internal programmatic changes should be made to reduce CO_2 emissions? This section will also rely on information from the literature review to support best practices recommendations and a timeline for companies to make these business process improvement changes.

2.0 Methods

This section describes the selection criteria and process for the companies reviewed and compared in my research. Next, the frameworks are shared that are used in my comparative data analysis of the companies' CSR programs and total carbon reduction. My goal in this framework is to create a comparative analysis of several qualitative and quantitative factors regarding how each company reports its environmental data.

2.1 Selection Criteria

The selected companies in this study needed to have enough in common to be comparable to one another, so a set of selection criteria was used to narrow down options. Within the technology industry there are companies that focus more on digital services than physical products, and all of these companies come in various sizes in terms of revenue and number of employees. A mix of physical business attributes, such as company size and geographic location, was used to narrow down the number of technology companies in my initial search. Next, I selected four

companies listed in the 2022 Dow Jones Sustainability North America Composite Index and 2022 S&P 500 Sustainability Screened Index.

2.1.1 Physical Business Attributes and Constraints

With the goal of comparing companies' business practices and outcomes to each other, I needed to select companies that 1) engage in similar business practices, 2) are in the same industry, and 3) are of a similar size. These factors give each company similar access to resources such as capital, grants, and investment opportunities. I did not filter companies based on whether or not they produce physical products (e.g., Google Nest thermostats, Apple iPhones) or simply provide online services (e.g., Salesforce's online tools and platform). Even though the carbon footprint of creating and producing physical products is substantial, online tools and platforms also produce carbon emissions, usually in the form of server buildings. Because of this similarity and because there are few online-only companies in the top 50 of the Dow Jones Sustainability Indices (DJSI) and S&P 500 Sustainability Screened Index (S&P), I did not differentiate or select for one type of company over another.

I wanted to select companies with main or headquarter offices located in the same geographic area, specifically the greater Bay Area region in California. Selecting a specific geographic region subjects the companies to the same federal, state, and local environmental policies. Lastly, I selected data from the years 2017-2019. This range of years offers enough selection in case some years have data reported more thoroughly than others. These years intentionally omitted the COVID-19 pandemic which started to directly impact businesses in the fourth quarter of 2019. The impact of the novel coronavirus on corporate CSR practices is an interesting question that can be answered in another research paper.

2.1.2 Dow Jones Sustainability Index and S&P 500 Sustainability Screened Index

I chose companies represented in the DJSI or the S&P 500 Sustainability Screened Index because each of these index funds has its own screening and selection system that aligns with my goal of finding companies that represent the largest organizations in the technology sector in

terms of revenue and sustainable action. An index fund is a tradeable investment that contains stocks from numerous companies. Each index fund has different criteria for inclusion (e.g., international companies, sector specific, small cap). This selection methodology mirrors that of Heninstoa Rakotoarisaona who used the DJSI to select companies for her USF Master's Project on the topic of conflict minerals (Rakotoarisaona, 2021). I am using the S&P 500 and the Dow Jones Sustainable Indices funds in order to have more companies from which to choose.

The DJSI contains 10 distinct index funds that track various regions of the world. Because my research area focuses on the Bay Area in California, I chose to select companies from the Dow Jones Sustainability North America Composite Index. This index contains 150 different companies, or constituents. Each of these companies have met benchmarks set by the Dow Jones (Dow Jones, 2022). The DSJI relies on the S&P Global Environmental Social Governance (ESG) score and Corporate Sustainability Assessments to determine whether or not a company meets the sustainability criteria for inclusion in any of the indices. The top 600 largest US and Canadian companies (with market capitalization of at least $500 million) are invited to submit sustainability documents for industry specific scoring. Some industries are excluded from further consideration including: alcohol, armaments and weapons, gambling, and tobacco. The Corporate Sustainability Assessments score in categories of governance and economics, social (diversity, equity, and inclusion), and environmental aspects (S&P Global, 2021).

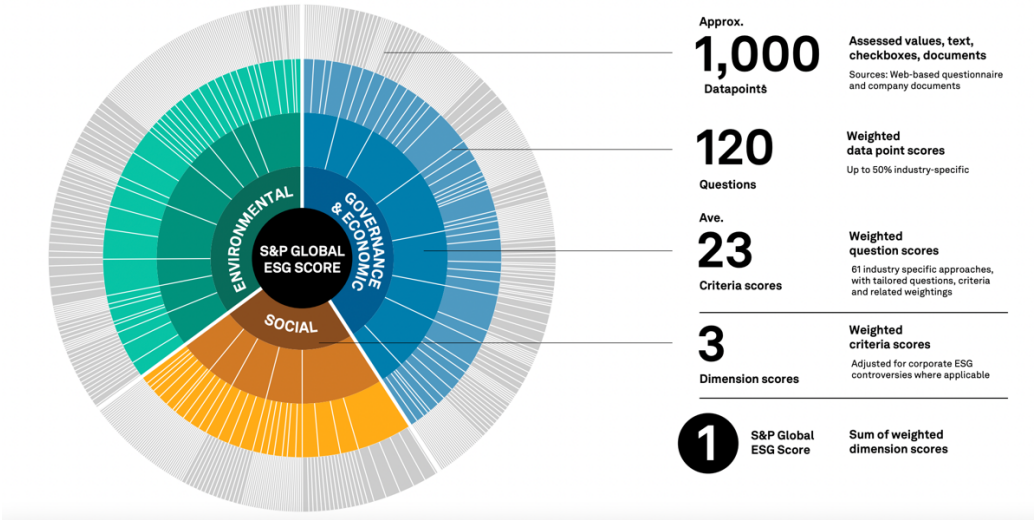


Figure 2: Example Corporate Sustainability Assessment. The CSA takes into account three categories of information, each weighted equally (S&P Global, 2021).

Of the eligible and selected 150 unique companies in the DSJI North America Composite Index fund, 35% are in the information technology industry. The next largest categories are in healthcare (e.g., AbbVie) at 15%, and financials (e.g., Bank of America Corp) at 11%. In this index, 90% of the companies are based in the United States. Companies that meet all of my criteria in this index include: Salesforce, Nvidia Corp, and Cisco.

The S&P 500 Sustainability Screened Index is a single index fund that contains 454 different companies, or constituents (S&P Global, 2022). Each of these companies have met benchmark requirements set by Standard and Poor's. To be considered, a company must first be included in the S&P 500, an underlying index fund containing the largest companies in the world by market capitalization. Some industries are excluded from further consideration including controversial weapons, small arms, tobacco, oil sands, shale energy, and thermal coal. The S&P uses a proprietary methodology to score greenhouse gas emissions data from eligible companies and convert six different greenhouse gasses into equivalent units of CO_2. This is a similar methodology to my own data analysis where I convert different categories of sustainability data from company CSR reports into a common CO_2e unit format.

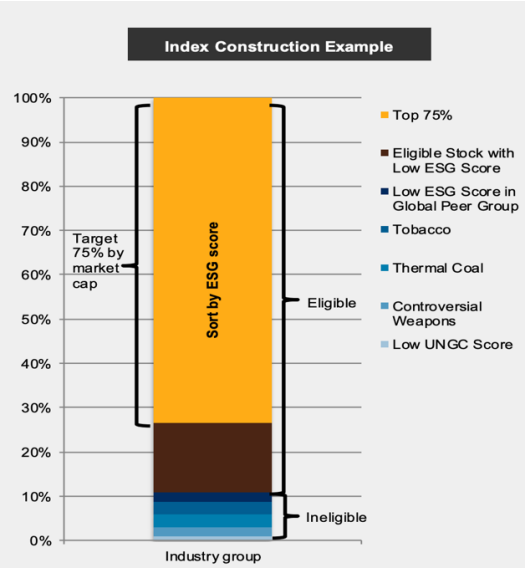


Figure 3: S&P 500 ESG Index selection methodology example. Companies in the S&P 500 submit documents for inclusion in the sustainable fund; ineligible industries are eliminated, then the lowest 25% scoring companies on the S&P Environmental Social Governance (ESG) are eliminated. The remaining companies are ranked by highest ESG score and weighted by float-adjusted market capitalization (Steadman et al., 2021).

Of the eligible and selected 454 unique companies in the S&P 500 Sustainability Screened Index fund, 30% are in the information technology industry. The next largest categories are in healthcare (e.g., UnitedHealth Group Inc) and communication services (e.g., Alphabet Inc A & C, Meta Platforms Inc.) with 13% each, and consumer discretionary (e.g., Amazon.com Inc, Tesla, Inc.) with 11%. All of the largest constituent information technology companies are based in the United States. Companies that meet all of my criteria in this Index include: Adobe and Nvidia Corp. Nvidia Corp is the only company that meets all of my selection criteria and all of the eligibility criteria for both the DJSI and S&P 500 Sustainability Screened Index funds.

2.2 Data Extraction & Organization

Each of the CSR reports used in this study was downloaded as a PDF from its respective company website. Each company chose to highlight the most recent data and report on its website so I searched to find the previous years' reports to collect data from my desired timeframe of 2017-2019. All report years reviewed in this report are from 2019. I transcribed the quantitative and qualitative information from each report into an Excel database. The database contains the title of each project, its goal, which utility it affects, any associated metrics, whether it is Scope 1, 2, or 3, and whether it impacts a business practice or aims to change employee behavior through Community Based Social Marketing (CBSM) techniques.

2.3 Comparative Framework

The comparative framework in this analysis of corporate CSR programs will include both quantitative and qualitative elements. The quantitative elements are the results of a tabulation of each company's sustainability activities. The qualitative elements summarize the types of programs undertaken by the companies.

2.3.1 Quantitative Framework

The quantitative information section contains the summarized data in units of metric tons CO_2e as reported by the technology companies. Equivalent tons of carbon dioxide (CO_2e) is a unit commonly found in all four of the CSR reports. This unit is also found in both of the

Environmental Protection Agency (EPA) calculators that I use. Because each company reports carbon emissions information in its own way, I have normalized the data so that it can be compared across the board. I am using two different standardizing calculations, one from Adobe's CSR report and one from Cisco's CSR report. Adobe's report puts carbon emissions in terms of employee worked hours while Cisco's puts carbon emissions in terms of revenue. Each of these ratios aid in understanding how carbon intensive the businesses are in relation to its size (annual revenue and number of employees).

The common comparison unit in this study, CO_2e, refers to equivalent metric tons of carbon dioxide. Carbon dioxide emissions, a potent greenhouse gas, is frequently used to compare environmental activities. By definition, a metric ton of CO_2 gas weighs one ton, or 2204.6 pounds. Using numerical conversion factors, other types of environmental activities with metrics, like kilowatt hours and pounds of food waste (i.e., using electricity and composting food scraps), can be converted into equivalent metric tons of carbon dioxide gas. Figure 6 in section 6.2.2 shows how the EPA solid waste calculator converts pounds of different types of solid waste in CO_2e.

2.3.2 Qualitative Framework

The qualitative information in this section contains categorized information about the types of CSR projects undertaken by the companies. In this section I will look at whether the projects are aimed at changing employee behavior (i.e., community based social marketing, CBSM), or directly impact business processes. I will count projects by what type of utility the project is aimed towards (i.e., waste, water, energy). Lastly, I will count projects by the objective of Scope 1, 2 or 3. This will show how far reaching the company is in its sustainability impact and how or if it takes responsibility for carbon emissions upstream and downstream from its core business operations.

4.0 Literature Review

This literature review contains background information regarding CSR reporting, metrics, and best practices. First, I will provide information about the three main types of Sustainability reporting tools. Sustainable reporting tools encompass the types of report outputs and tracking

systems available to companies that want to report sustainability metrics. They come in three main categories: frameworks, standards, and ratings and indices. This information aids in understanding how CSR reports are constructed, what types of information they share, and how they can be improved. Second, I will discuss business energy mix options best practices for data centers. This energy section ties into aspects of the CSR report that indirectly contributes to carbon emissions as well as two of the most immediate ways in which businesses reduce carbon emissions. Third, I distinguish between two main processes through which companies can address environmental programs: business processes improvement and employee behavior. Improving or changing business processes, such as switching suppliers or redesigning a data center, has a direct lasting impact. Changing employee behavior to more sustainable options is an ongoing training process.

4.1 Corporate Social Responsibility Reporting

Because my comparative analysis relies on CSR reports, it is important to understand how these types of reports are compiled and published. From a public relations standpoint, companies are more likely to tout successes rather than their failures. Similarly, companies are more likely to report environmental information when there are successes to share (Clarkson, 2008). However, the field of CSR reporting remains largely unregulated and unstandardized. As more corporations in a wide variety of industries incorporate sustainability and CSR reporting into the business structure, a wide variety of tools are needed to accurately capture and report on sustainability metrics.

4.1.1 CSR Reporting

Each of these sustainability reporting tools (Siew, 2015) have different methodologies, criteria, levels of transparency, and format. Even the term “sustainability” as defined by the 1987 United Nations Report “Our Common Future” (Brundtalnd, 1987) leads to interpretation and confusion, meaning it is difficult to operationalize into business process improvements. However, because business stakeholders demand action and transparency surrounding sustainability, measurable steps and results need to be communicated. Sustainable Reporting Tools communicate between a company and its customers, shareholders, suppliers, and competitors. sustainable reporting tools can also help to meet government regulatory requirements for transparency and reporting.

There are several drawbacks to sustainable reporting tools as they currently exist. First, there is a lack of clear standardization for criteria and methodology between the various types of sustainable reporting tools. Often this is necessary because each industry has its own unique set of items on which to report. Some sustainable reporting tools, such as ISO14001 which is used in many different types of industries from manufacturing to hospitality, aim for a more generalist approach in order to gain more users. Second, different sustainable reporting tools have different outcome goals. Is the goal to record past successes or future plans? Is there a focus on social justice in addition to sustainability? An organization may have different takeaways depending on which sustainable reporting tools they choose. Third, sustainable reporting tools do not always come with recommendations for further sustainable best practices or technological improvements. Calculating a carbon footprint is not useful when the business does not know what to do with the information. Fourth, mitigation practices with negative externalities can get undue attention and support.

Siew (Siew, 2015) recommends shifting more criteria from quantitative rather than qualitative to gain more detailed information about the types of sustainability programs, reduce the compartmentalization of various sustainability criteria, and incorporate space for more uncertainty and variability. He also recommends setting a common standard so as to better benchmark corporations against each other. In my data analysis I utilize two normalization equations to compare carbon emissions in terms of company size and revenue. The following three sections will further detail the main types of sustainability reporting tools used by the companies in this study: frameworks, standards, and ratings and indices.

4.1.2 CSR Reporting: Frameworks

Environmental frameworks in a business setting can give a company structure for a new sustainability program. Rather than a strict set of requirements, frameworks provide principles and guidelines. The Global Reporting Initiative, World Business Council for Sustainable Development, and Carbon Disclosure Project are just a few examples of the available frameworks from which businesses can choose. Frameworks can save a company time and money, making CSR programs more accessible. They are also easily customizable to different

industries and organizations. For example, the Global Reporting Initiative offers a modular approach for each organization to create its own specialized program using GRI's guidelines. The Global Reporting Initiative also has integration with the Sustainable Development Goals to further enhance both sustainability outcomes, program rigor, and credibility (Global Reporting Initiative, 2021). All four of the selected companies in this study utilize aspects of the Global Reporting Initiative methodology.

4.1.3 CSR Reporting: Standards

Sustainability reports do not necessarily have to follow any set of guidelines unless the company is seeking or maintaining certification through a third party. Standards provide companies with formal documentation and guidelines for best practices within that specific industry. Programs such as LEED (building construction and management, EMAS (Eco Management and Audit for evaluating environmental performance), and ISO14001 (generic environmental management) offer clear requirements and utilize report templates for companies to use. Other companies choose to develop personalized in-house sustainability programs and their own reporting tools and metrics. One benefit to standardized report templates is readability and transparency. Standardized reports are easier to compare year over year as well as in comparison to other companies utilizing the same report structure. Interestingly, companies with easily readable reports tend to have stronger environmental outcomes (Wang et al., 2018). Another benefit of standards is a competitive business advantage. Businesses can differentiate themselves in crowded markets by showcasing successful environmental certifications, ratings, or programs. These pre-built standards often have different rankings, such as the Green Restaurant Association, with higher ratings resulting from more significant environmental management programs that directly impact the business process (Green Restaurant Association, 2022).

4.1.4 CSR Reporting: Ratings & Indices

Third party evaluations of environmental performance can be rewarding for companies when they result in favorable ratings inclusion in indices. Ratings generally follow standards set by the rating organization. For example, the S&P 500 Sustainably Screened Index and Dow Jones Sustainability Index funds each have its own requirements for entry. Inclusion in indices has a

beneficial business impact because it exposes the company to a wider stakeholder group and creates a peer group of businesses excelling in industry fields while increasing sustainability. This beneficial financial component fulfills one piece of the Triple Bottom Line and helps create stronger companies (Schmutz et al., 2020). Inclusion or lack thereof in an index is based on many factors set by the rating agency, but there is a level of detail hidden from the public's view. The actual score or rating derived from the Index Fund eligibility requirements is considered private information. Inclusion or lack thereof is the only rating outcome available to members of the public. In comparison, CSR reports contain much more information and specificity in regards to projects, programs, goals, and successes.

4.2 Carbon Emissions, Calculations, & Accounting

This section contains information about types of energy and electricity available to information technology companies and its impact on carbon emissions, and Scope 1, 2, and 3 emissions accounting. Energy and electricity sources, whether renewable or based on fossil fuels, can be measured and altered to fit the company's budget and climate goals. Scope 1, 2, and 3 emissions accounting is a standardized methodology used by all four companies in the study.

4.2.2 Energy

Choosing what type of energy to purchase and use is one of the most impactful sustainability choices a business can make because conventional energy generation directly contributes to carbon emissions. The extraction, processing, and burning of fossil fuels for energy all emit greenhouse gasses such as CO_2. Some machines must run on fossil fuels, such as a diesel-powered backup generator, but buildings often rely on a mix of electricity and fuel to run. Electrification of a system is a powerful force because electricity can be powered by fossil fuels or renewable energy sources (i.e., solar, wind, hydroelectric). Renewable sources of energy are less carbon intensive than fossil fuel counterparts, and in recent years they are more cost effective.

Depending on the location of the business, local energy companies may be able to offer different energy mixes to the customers. In the Bay Area, where all of the companies in this paper are located, Pacific Gas & Electric (PG&E) is the main supplier of energy. Communities may form a

Community Choice Aggregate (CCA) company to purchase its own electricity, or it can generate its own through solar panels or other means. In California there are twelve CCAs including Silicon Valley Clean Energy, San Jose Clean Energy, Peninsula Clean Energy, and CleanPowerSF. These CCAs offer a less carbon intensive energy mix than PG&E, but they also come with a higher cost. For example, a large commercial customer (such as any of the companies in this report) can choose to buy its energy from the Silicon Valley Clean Energy at the most expensive GreenPrime tier for $0.207/kWh compared to PG&E at $0.200/kWh (PG&E, 2021). Fossil fuels comprise 15% of the PG&E energy mix. Fossil fuels comprise 0% of the Silicon Valley Clean Energy mix. This is because the Silicon Valley Clean Energy mix is comprised entirely of solar, wind, and other renewables (SVCE, 2020).

Table 1: Comparison of price per kilowatt hour of energy purchased for a large commercial business at each energy companies' most sustainable energy mix option (PG&E, 2021).

Company	Price (Large Commercial Rates)	Fossil Fuel Component
Pacific Gas & Electric	$0.200 /kWh	15%
Silicon Valley Clean Energy	$0.207 /kWh	0%

While none of the four reviewed companies disclose exactly which energy provider it purchases its electricity from, information regarding various types of energy mixes is important to understand corporate sustainability goals regarding carbon neutrality and renewable energy. Local market energy mix availability data is used by each company when calculating greenhouse gas emissions. These calculations known as market-based and location-based methodology are detailed in the quantitative CSR report summary section.

4.2.3 Carbon Emissions from Energy Sources

In order to reduce carbon emissions, carbon free sources of energy should be prioritized and utilized whenever possible. CSR reports can be a place where businesses state renewable energy goals and progress. Reporting frameworks used by the four companies in this study, such as the Global Reporting Initiative, include requirements for energy reporting. Businesses in the Bay Area have the option to utilize low to zero carbon sources of electricity for their companies, such as Silicon Valley Clean Energy. Solar, wind, biomass and biowaste, geothermal, and eligible

hydroelectric are all examples of renewable energy sources in California. There are other sources of carbon emissions from technology companies such as employee travel to and from work, material extraction, manufacturing, transportation of office goods, and waste disposal. These other sources of carbon emissions are not directly related to the business because the emissions are created somewhere else.

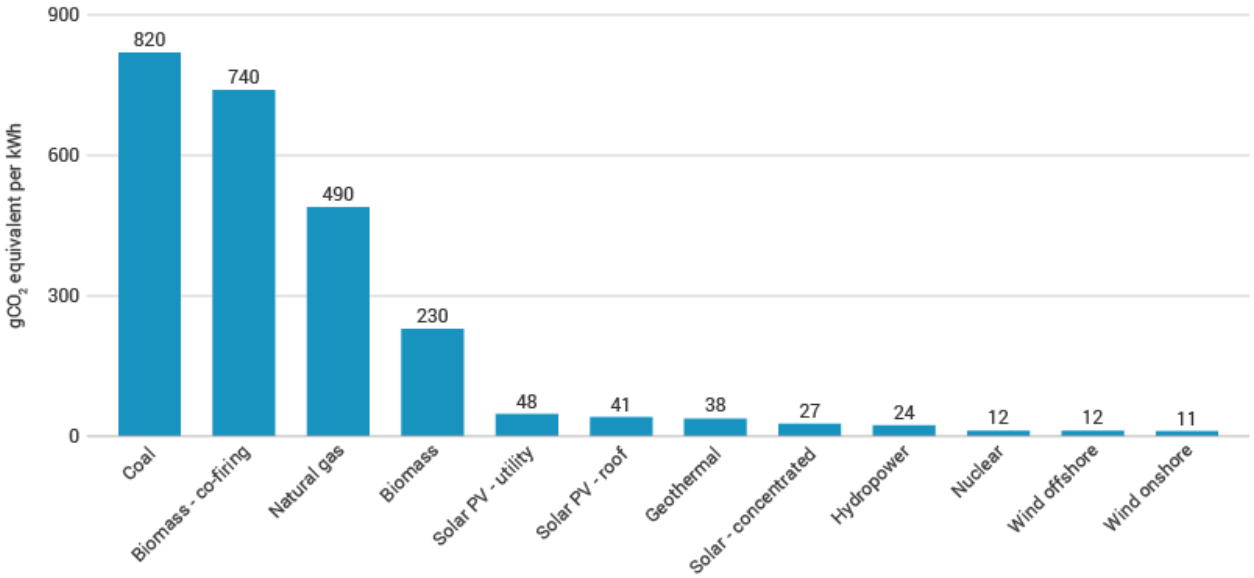


Figure 4: Average life-cycle of carbon emissions (CO_2e) in terms of grams of CO_2 per kilowatt hour (kWh) (Schlömer et al., 2014). The energy sources are ranked from highest to lowest carbon emissions per unit of energy generated.

4.2.4 Scope 1, 2, and 3 Accounting

Scope 1, 2, and 3 emissions refer to the proximity of the responsibility of the organization over the greenhouse gas emission or practice. Scope 1 emissions are those directly tied to the actual business practices of the organization (i.e., electricity for an office building or gas for fleet vehicles). Scope 2 emissions are those indirectly related to business practices (i.e., purchase of energy). Scope 3 emissions are even further indirectly related to business practices and can be upstream or downstream from the company (i.e., employee transportation, supply chain emissions and activities).

Companies can choose whether to account for only Scope 1 emissions, or they may choose to account for and report all three scopes. All four companies reviewed in this paper report their Scope 1, 2, and 3 emissions. A company has the most control over their Scope 1 emissions

because the company is, by definition, directly responsible for the choices that result in those emissions. Scope 3 emissions, those caused by suppliers and other external parties, can be challenging to accurately account for because the company must collect data from outside its own organization. Scope 3 emissions are outside the sphere of control for a company, so including them in its CSR reporting shows a level of transparency and awareness of the company's impact up and down the supply chain.

Awareness and acknowledgment of Scope 3 emissions can also bring about sustainability projects that reach beyond the core business practices of the company. For example, Cisco took a carbon emissions inventory of its supply chain for products sold and set a goal of reducing that Scope 3 metric by one million metric tons of CO_2e. Cisco claims these emissions reductions stem from altering its sourcing strategies, changing its product fulfillment model, reducing manufacturing-related energy use, and optimizing transportation of materials. Cisco can influence its supplier partners to improve its sustainability but the partners must take on the actions themselves.

4.3 Facilities

Buildings and data centers are the foundational underlying physical spaces of information technology companies and are integral to their day-to-day operations. This section contains information on how data centers where computer servers are stored and operated contribute to carbon emissions.

4.3.1 Data Centers Overview

Using the Intergovernmental Panel on Climate Change categorization methodology, information technology companies emit greenhouse gasses in the "commercial buildings" category (Lucon et al., 2014). Based on data from 2010, the Intergovernmental Panel on Climate Change found that 8% of total greenhouse gas emissions came from commercial buildings, and of that amount 65% was attributed to heating and cooling (IPPC, 2014 Figure 9.4).

Computer servers, the physical processors of the information technology industry, store, process, and share data. They are energy intensive, requiring energy to maintain the functionality of the

servers, keep the building where they are stored cooled to an optimal temperature, and utilize the technology stored on the computer servers. Data centers vary in terms of energy efficiency, but they can be 100 to 200 times as energy intensive as an office building (M. Dayarathna et al., 2016). Information technology companies have large server capacity onsite to optimize business productivity and to save costs on renting additional unneeded offsite server space. Some servers cannot be turned off, even when not in active use, and this active idling only adds to overall energy consumption.

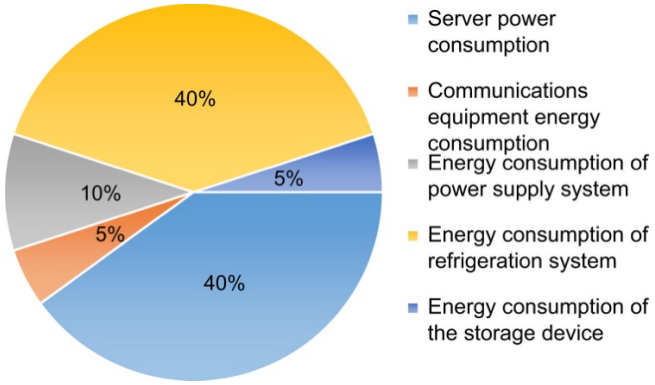


Figure 5: Energy consumption distribution in data centers by percentage. The energy usage is mostly split between building cooling and operating the computers and servers (Rong et al., 2016).

Data centers do not necessarily have to be located in close geographic proximity to any other company office buildings. This creates an opportunity for energy efficiency in three ways: (1) economies of scale, (2) access to renewable energy markets and generation, and (3) taking advantage of synergistic climates.

4.3.2 Data Centers Energy Efficiency Best Practices

An inventory of four frequently cited review articles from Q1 journals on the topic of renewable and energy efficient data centers published in the past decade shows many similar recommendations.

Table 2: A table summarizing the data center energy efficiency best practices of four review articles and the specific recommendations of the authors based on their findings.

Best Practices	**High Performance Computing Software**	**Renewable Energy**	**Low-Power server design**	**Energy conservation of computer rooms (airflow patterns)**	**Site Selection**	**Waste Heat Recovery**	
	General recommendation	Smart grids	General recommendation	Hot/cold aisle design	Locate near naturally cold areas or water rich areas		(Rong et al., 2016)
	Surge guards	Smart grids	Data Center Network physical configuration	Hot/cold aisle design	Locate near renewable energy generators		(Hammadi and Mhamdi, 2014)
	General recommendation	Generate energy onsite and purchase from third-parties	Turn off idle servers, consolidate tasks to active servers	Hot/cold aisle design Operate buildings on the warmer side Vary cool air flow intensity to match active hot spots	Locate near cold climates, cold water climates Locate in areas suitable for onsite renewable energy generation	Use waste heat to warm nearby buildings	(Oró et al., 2015)
		Generate energy onsite and purchase from third-parties		Hot/cold aisle design	Locate near naturally cool climates	Waste heat recovery to operate vapor-absorption based cooling Heat nearby buildings	(Shuja et al., 2016)

(1) Economies of scale, or scaling up, allow business systems to work more smoothly at larger capacities. Scaling up is an energy efficient way of achieving greater outputs with fewer inputs per item. Adding an additional row of data servers to an already existing space or moving to a larger building only requires a marginal increase in energy consumption per server. To grow and scale-up to meet industry demand while remaining cost-effective, data centers need to be energy efficient.

(2) Geographic location matters in the renewable energy field because different energy providers compete in different markets. In California two main energy providers, Southern California Edison and Pacific Gas & Electric, each control a different geographic territory and provide energy only to their own customers. Therefore, customers are severely limited in their choice of energy provider and renewable energy options. The following section goes into greater detail on community choice aggregates, which are one way for customers to select renewable energy.

Site selection favors naturally cool areas, and water-rich areas for water-cooled (swamp cooler) facilities. Google is building a data center in northern Europe and Facebook is building one in Sweden. Indoor air temperature should be (23±1) °C and humidity between 20-80%. Too low humidity can cause electrostatic charge issues, and too high humidity can cause condensation which can damage the electronics and wiring.

Interxion, a company operating 285 data centers, uses cold seawater to cool its data center structure in Stockholm, then the warmed water is used to heat nearby office buildings. The now ambient temperature water can be returned to the sea without creating a hot spot and harming the local ecosystem. This seawater cooling/heating project reduced the data center's temperature-control energy costs by 80%, and lowered its Power Usage Effectiveness to an incredible 1.08 on the scale of 1-2 where 2 is least energy efficient and 1 is most energy efficient (Verge, 2013).

(3) Data servers must remain cold to properly function and avoid overheating which can cause hardware and software failures. Data server buildings are climate controlled through conventional methods such as air conditioning, insulation, and air circulation. A common design

and installation layout practice is the “hot aisle/ cold aisle” method. Servers are stacked such that the warmer sides of the servers face each other. This allows the warm air to be vented out of the way, and the cold air to cool the servers (Cho and Kim, 2011). Ventilation patterns vary by building and are constrained by the physical layout design of the floorplan. “hot aisle / cold aisle” methods are considered best in terms of avoiding hot and cold air mixing while maintaining circulation and overall cool temperatures.

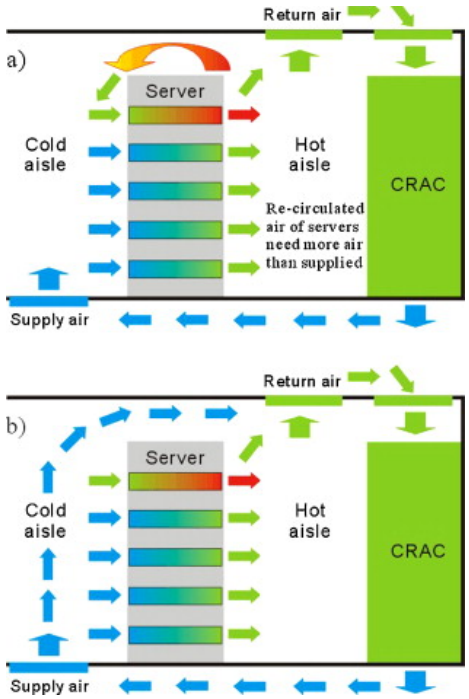


Figure 6: Data server stack and computer room air conditioning unit with directional arrows showing (a) inefficient re-circulating air flow with warm air mixing with cooling air and (b) more efficient by-pass air flow preventing warm and cool air mixing in the cool aisle (Cho and Kim, 2011).

Air conditioning is considered to be the most energy intensive option (and the most expensive), so data server companies have experimented with locating data center buildings in climates that aid in cooling the servers. Two such amenable climates are very cold places and very dry places. Cold climates contribute naturally cool air which can be circulated inside the server building and reduce artificial cooling costs and energy requirements. There is a possible risk of outside contamination to the server equipment when cool air is brought in from the outdoors, so air filters must be used to reduce particulate matter.

Dry climates are suitable to evaporative cooling (swamp cooling). In swamp cooling, air circulates through wet pads that take on excess ambient heat, then the cooled air recirculates into the data server building. The warm humid air can damage the evaporative cooling equipment, so dryer climates are most suitable for this type of less-energy intensive cooling (Rong et al., 2016).

Liquid cooling is more energy efficient than air cooling, but it poses potential hazards by bringing liquids in close proximity to sensitive electronics. Instead of water, refrigerants can be used. In the future, the energy best practices for server rooms may be fully submerging the servers in cool liquid to maximize cooling efficiency.

(4) Renewable energy can be unreliable because it relies on environmental conditions such as windspeed and sunshine intensity. Smart grids that can switch between energy sources grant data centers the flexibility to use renewable energy when it is available without compromising server performance. Onsite renewable energy generation incurs less loss due to long transmissions and multiple conversions, but it requires more capital resources and investments from the company. It also may be less efficient if the data center is not optimally located for renewable energy generation in terms of favorable local climate conditions and economic incentives. There are growing improvements in renewable energy price and availability consistency, battery storage, and economic incentives to installing new renewable energy systems.

Future designs in data server facilities explore the possibilities of modular computer data centers built in self-contained shipping containers. These modular units can be shipped and located in advantageous locations for renewable energy and natural cool/wet climates. The units are also compatible with best practices in hot aisle /cold aisle air circulation, and are easily scalable.

(5) Servers in data centers are connected to each other via switches and routers. The way servers are physically wired together can improve power consumption efficiency by balancing traffic between the servers. Low-energy server design and higher efficiency computer chips both contribute to energy savings. While it may be tempting to turn off servers not in use, this practice

can overheat the remaining servers and create additional stress on the air-cooling system. Surge guards can minimize those negative effects by dispersing added load to multiple servers.

(6) Heat-generating data centers create an opportunity for heat redistribution to residential and commercial buildings.

4.3 Target of Sustainability Projects

This section contains information about the two objects of sustainability projects: business processes and employee behavior. Some ways in which businesses can change business practices include changing suppliers, buying more renewable energy, and redesigning physical spaces and products for energy efficiency. Some ways in which businesses can change employee behavior include offering commuter benefits, organizing community volunteer days, and nudging employees towards beneficial environmental behaviors.

5.3.1 Business Processes

Redesigning a business process or the business model itself is known as “strategic sustainability” (Sarkis and Sroufe, 2004). An example of redesigning a business process might be implementing a supply chain sustainability program to require materials suppliers to use recycled content in manufacturing. An example of redesigning a business model is creating a product repair clinic to increase product longevity. Both of these activities impact day to day business operations while creating opportunities for innovation and environmental improvement. Strategic sustainability puts environmental awareness and importance at the core of the business model. In a similar system of thinking as the Triple Bottom Line, strategic sustainability integrates environmental and CSR projects into all levels of an organization. Aligning sustainability with business processes is especially impactful for software developing information technology companies because it is the primary business objective.

Adobe and Salesforce both design and operate software systems, software products, and data centers as core to their business models. Strategic sustainability and sustainable software engineering apply to all three of these business ventures.

4.3.2 Community Based Social Marketing

Community Based Social Marketing (CBSM) is a system of practices based in psychology that encouraging people to change their behavior (McKenzie-Mohr and Smith, 1999). These practices remove barriers and reward preferred options while creating barriers to alternative options. The system follows the scientific method by first identifying the desired behavior change, selecting the system for nudging towards that change, and evaluating the outcome for broad scale implementation. The systems for nudging towards behavior change are: commitments and pledges, setting social norms, increasing social diffusion, utilizing prompts, communicating desired behavior changes, offering incentives, and making the preferred choice the most convenient.

CBSM style practices often appear in CSR programs aimed at employee practices even if the project does not directly reference CBSM. For example, Cisco reduced Scope 3 emissions from employee commuter travel to its San Jose headquarters office by offering a free shuttle service in lieu of individuals driving their own cars. Many employees take the shuttle which creates a social norm around carpooling together, and the visual of the shuttles arriving at the office may prompt other employees to ask if a shuttle route can be added to their city. Employees are incentivized to take the shuttle by saving money on gas and by having the convenience of being able to relax or work on the shuttle rather than driving to and from work.

A search for peer-reviewed literature on CBSM from 2000-2022 in the Environmental Science sector returned 163 papers. The top relevant papers discuss how CBSM can be used to improve environmental regulations, policy, and programs across a variety of fields including public health, agriculture, environmental conservation, and fisheries. Many were review articles outlining the steps of how to foster sustainable behavior in people (Kennedy, 2010).

CBSM was not featured as a factor impacting sustainability programs or impact in any of the literature reviewed for this study. The following section on similar research studies outline the methods and research questions of three CSR report analyses. The research questions include topics such as data transparency, sustainability considerations in software development, and how CSR practices spread from one country to another. My research question of how companies

decide where to direct their sustainability efforts, either towards employee behavior change through CBSM or improving business processes, was not addressed in any of these studies.

4.4 Similar Research Studies

The first similar research study assessed the credibility and truthfulness of CSR reports in 11 European countries from a stakeholder perspective (Lock and Seele, 2016). The study found the current status of voluntary standardization led to more understandable and readable reports compared to readability set by regulatory interventions. This study chose 237 companies from various industries selected from European stock indices, and report years from 2011-2013. The researchers performed a content analysis of the CSR reports. This paper highlights the ability for companies to select what data and projects get reported on, and that the reports primarily act as self-congratulatory public relations documents rather than a factual accounting of environmental actions. In an effort to increase transparency, the authors recommend using the Global Reporting Initiative framework because it uses standard terms, reporting methods, and can be made industry specific.

The next study asked whether software sustainability is considered in CSR, and the study used a similar methodology of extracting CSR report data into an Excel database to compare qualitative information (Calero et al., 2019). They chose the top 10 companies based on their revenue and relevance in the industry. The study asked research questions centered around what aspects of CSR the companies pursued: social, economic, or environmental. The researchers found that companies lacked sufficient environmental projects compared to the numerous social and economic projects. The researchers proposed a list of ways for companies to improve sustainability in the existing economic and socially focused programs and projects.

The final study used a longitudinal study in order to compare 29 companies' CSR reports across 15 years in Pakistan (Khan et al., 2020). The authors wanted to see how United States CSR report values and methods were spread to other countries (i.e., Mexico, Taiwan, India, Pakistan). Methodologically, the authors chose 29 companies from the Pakistan Stock Exchange and used a content analysis to codify the CSR qualitative and quantitative information into categories for analysis. This codification of qualitative and quantitative report information is similar to the

report database in this study of only four companies. The researchers counted keyword mentions of CSR topics across the reports to gauge interest and attention to those topics over time. They found that public image perception was the strongest motivator of CSR reporting followed by actual substantive sustainability actions. This finding falls in line with their observation that companies, such as British Petroleum, can win awards for their CSR reports while simultaneously degrading the environment (Wickman, 2014).

5.0 CSR Report Analysis

5.1 Company Information

I selected four companies for this study: Adobe, Cisco, Nvidia, and Salesforce. My selection criteria, as outlined in greater detail in the methods section, centered on their inclusion in sustainability focused financial index funds. In this section I will detail the general information of each company to provide context for the content of their respective CSR reports. Two of them, Adobe and Salesforce, have exclusively digital products. The other two, Cisco and Nvidia, have a mix of digital and physical products. This coincidental delineation in my company selection makes for a balanced comparison between each of these two sets and all four together.

5.1.1 Adobe

Adobe makes digital tools allowing businesses and individuals to edit, e-sign, and share digital documents. Its suite of software products includes downloadable offline and cloud storage online options. Adobe product titles include: Photoshop, Acrobat, Creative Cloud, Adobe Scan, Adobe Sign, and analytics products in the Adobe Experience Cloud. Because none of these products contain a physical component, the entirety of its product line exists in data servers. Data server buildings require energy to run and maintain the servers as well as to keep them at cool temperature.

Founded in 1982 in Mountain View, California, Adobe pioneered many technologies, such as software for digital photo editing and translating images of print into computer text, as well as the now ubiquitous PDF format for documents. More recent innovations, including electronic signatures for documents, have kept the company in the forefront of its industry. Adobe’s mix of

free and premium paid products also adds to its widespread proliferation in the online and offline computer space.

5.1.2 Salesforce

Salesforce hosts and organizes customer information online for other companies, making it a business-to-business organization. Its niche of customer relationship management software, has grown over the past decade into a must-have for businesses. Customer relations management software uses data analytics to track and manage clients, potential customers, and other stakeholders with the aim of improving business relationships. CRM can also be used for internal customers, such as connecting a team of people from different departments on a single project.

Founded in 1999 in California, Salesforce sells its CRM software to businesses who use it to track and manage their own customers and clients. Salesforce's software-only approach makes the company similar to Adobe. Salesforce has its own managed data centers in 11 cities/regions across the globe. As Salesforce the company and CRM the business service both continue to grow, Salesforce also has an online modular training platform, Trailhead, that guides users in Salesforce capabilities.

5.1.3 Cisco

Cisco manufactures electronic products to create networked systems, and it also sells digital products such as its online system hosting program. Cisco's physical products include routers, switches, and other telephonic and video conferencing equipment. Cisco's digital products include cybersecurity, the wireless systems that run on its hardware, and digital networks.

Founded in 1984 in Mountain View, California, Cisco's services are used primarily by other businesses. Cisco operates data centers to run its own products, and it offers server hosting to its customers. Securely networked systems are important for organizations of all types, including hospitals, financial institutions, and government agencies.

5.1.4 Nvidia

Nvidia designs and manufactures computer processing chips. Computer chips are the hardware required for any "smart" electronic to run on, from programmable toasters to laptops to autopilot in airplanes. Nvidia's graphics processing unit cards are especially popular in the video game industry and the growing field of artificial intelligence. Nvidia's other top customers include the automobile industry, cryptocurrency mining, and the robotics industries.

Founded in 1993 and based in Santa Clara, California, the company took off in 1999 with the invention of the graphics processing unit. The graphics cards have been designed for specific gaming systems, and its advances have fueled innovation across the entire industry. Nvidia's software products are built to support the capabilities of its hardware. The names of its software products include CUDA Developer, IndeX, Iray, Multi-GPU, Optimus, and PostWorks. Many of these technologies relate to graphics processing, designing, editing, and orienting in 3D.

5.2 CSR Report Data Normalization & Conversion

In the first subsection section I describe the methods of normalizing the four companies CSR quantitative data. The data normalization equations both result in a 'carbon intensity' number. The first asks how many units of CO_2e are emitted for each employee. The second asks how many units of CO_2e are emitted for each dollar in revenue. The following subsections show how two EPA calculators converted energy and waste data into units of CO_2e. Converting more environmental metrics into this reports' comparable unit, CO_2e, allows for a more complete analysis of each company's sustainability projects and progress.

5.2.1 Normalizing Carbon Emissions Data

I used the CSR Excel database to convert units to metric tons of CO_2e in order to normalize and compare the companies to each other. To normalize the data, I followed equations used by some of the studied companies. Adobe and Cisco each have a method of normalizing carbon emissions data. Both of these companies use combined Scope 1 and 2 metric tons of CO_2e as the numerator.

Nvidia: Normalized Carbon Intensity

$$\frac{[Tons\ of\ CO2e\ (Scope\ 1+2)]}{Total\ Employees}$$

Cisco: Normalized Carbon Intensity

$$\frac{[Tons\ of\ CO2e\ (Scope\ 1+2)]}{\$1\ Million\ in\ Revenue\ (USD)}$$

For this study, I have added in Scope 3 emissions because while those emissions are created by other parties and partners to the organization, the emissions are still tied to the core business models of the companies.

Study Normalized Carbon Intensity

$$\frac{[Tons\ of\ CO2e\ (Scope\ 1+2+3)]}{\$1\ Million\ in\ Revenue\ (USD)\ or\ Total\ Employees}$$

Adobe divides the carbon emissions by full-time equivalency (FTE). FTE is an employee metric that divides a worker's hours by a standard 40-hour work week. So, one worker completing a 40-hour workweek is equivalent to 1.0 FTE. A part time worker completing a 20-hour workweek is equivalent to 0.5 FTE. The units for this calculation are tons CO_2e /FTE. Nvidia also uses a greenhouse gas emissions intensity equation factoring in employees and Scope 1 and 2 emissions.

Cisco divides the carbon emissions by million dollars in revenue. Revenue is a financial metric that includes all income to the company. Revenue is different from profit; profit is revenue minus expenses. Cisco chose to use revenue rather than profit without stating a reason why. Cisco may have chosen revenue rather than profit because profit includes further calculations (revenue minus expenses) and therefore more variables. Alternatively, Cisco may have chosen revenue over profit because revenue is a larger number which results in a smaller ratio and lower appearing carbon intensity ratio. The units for this calculation are tons CO_2e /$1million.

5.2.2 Converting Energy and Waste Data to Carbon Emissions

The EPA's Waste Reduction Model (WARM) and Greenhouse Gas Equivalencies Calculator (US EPA, OAR, 2015; US EPA, OLEM, 2016) both convert business processes into greenhouse gas emissions. The WARM model converts units of waste, recycling, and compost into metric tons of CO_2e. The calculator can also calculate greenhouse gas emissions equivalences for materials reductions.

GHG Emissions Analysis -- Summary Report

Version 15

GHG Emissions Waste Management Analysis for Nvidia CSR Report 2019

Prepared by: Natalie Calhoun

Project Period for this Analysis: 01/01/19 to 12/31/19

Note: If you wish to save these results, rename this file (e.g., WARM-MN1) and save it. Then the "Analysis Inputs" sheet of the "WARM" file will be blank when you are ready to make another model run.

GHG Emissions from Baseline Waste Management ($MTCO_2E$): (12,905.74)

Material	Tons Recycled	Tons Landfilled	Tons Combusted	Tons Composted	Tons Anaerobically Digested	Total $MTCO_2E$
Mixed Paper (primarily from offices)	29.00	-	-	NA	NA	(103.81)
Mixed Electronics	178.00	-	-	NA	NA	(139.79)
Asphalt Concrete	5,000.00	-	NA	NA	NA	(404.65)
Dimensional Lumber	2,500.00	-	-	NA	NA	(6,653.35)
Drywall	5,000.00	-	NA	NA	NA	130.43
Fly Ash	2,500.00	-	NA	NA	NA	(2,163.22)
Mixed Recyclables	1,288.00	-	-	NA	NA	(3,675.03)
Mixed Organics	NA	-	-	1,008.00	-	(87.13)
Mixed MSW	NA	617.00	-	NA	NA	190.79
						0

Figure 7: The EPA WARM greenhouse gas emissions analysis summary report for Nvidia's 2019 CSR report. User inputted data into the material fields automatically generates metric tons of CO_2e. Numbers in parentheses "( )" are negative, meaning that greenhouse gas emissions are avoided by sending those items to landfill alternatives like recycling and composting.

The EPA Greenhouse Gas Equivalencies Calculator does similar work by converting various units of energy into equivalent units of metric tons of CO_2.

In my CSR Excel database, I was able to convert waste and energy metrics into equivalent units of CO_2 emissions to have more comparable data points between the various companies. This generated information on the companies Scope 1, 2, and especially Scope 3 activities because much of the energy consumed by each organization came from external partners such as suppliers and third-party data centers.

5.2.3 Energy Data Collection Location and Market Based Methodology

Three of the four companies in this study used both location-based and market-based accounting methodology in the CSR reports. These methods are outlined and included in several reporting frameworks and programs including the World Resource Institute, World Business Council for Sustainable Development, and Climate Registry. Location-based and market-based methodology applies primarily to Scope 2 emissions because those emissions are created through energy used by the business (Sotos, 2015).

Location-based emissions reporting takes into account the average emissions factors for the local electricity grid and energy mix options. To use this approach, the reporting group takes all of the energy companies in the area and calculates the average of the different energy mix options and applies that to all of the Scope 2 emissions reported by the company. For example, as detailed in section 4.2.2, there are 12 community choice aggregates for purchasing energy in California and two main energy providers. A location-based approach for the entire state of California would take the energy mixes for all 14 options and take the average as the location-based emissions factor for any business buying energy in California. This emissions factor can be useful when specific energy purchasing information is unknown because it can be extrapolated to gain a baseline figure or surmise information about similar businesses in that area. It can also be made more accurate by narrowing in on a specific location and therefore reducing the number of energy provider options available to a company in that specific location.

Market-based emissions reporting considers the actual power purchasing practices of the business from its actual energy providers. This system requires access or knowledge of power purchasing contracts between the business and the energy provider. Market-based emissions factors are much more accurate because they utilize the actual energy mix purchased by the company instead of an average of energy mix options available in their area. However, this detailed specific information is challenging to obtain or verify from a third-party perspective. In my research of four companies in the Bay Area, all four used market-based and location-based Scope 2 emissions reporting. In my data summary, I use the market-based emissions factor when available because it is more accurate.

To show the difference in market-based and location-based reporting, the following table displays the two types of reported data for the four companies as reported in each CSR report. Table 3 shows the difference in location-based versus market-based emissions accounting. Nvidia only reported location-based information, but all of the other three companies show location-based numbers as higher than the market-based information. This discrepancy exists because market-based accounting is more accurate because it uses the actual market price and energy mix that the companies purchase.

Table 3: A comparison of the four companies in this study and the reported market-based and location-based Scope 2 annual emissions (Adobe, 2019; Cisco, 2020; Nvidia, 2019; PG&E, 2021; Salesforce, 2019). The percent change from location to market-based methodology calculates the percentage difference in the two types of accounting. The rightmost two columns report the PG&E rates for their least renewable (40% renewable) energy mix for commercial customers and most renewable (75% renewable) energy mix.

Company Name	Scope 2 Metric tons CO_2e	Methodology	% Change from Location to Market Methodology	Equivalent MWh	Annual Cost of PG&E Standard Rate per kWh $0.24 in Millions USD	Annual Cost of PG&E GreenPrime per kWh 0.25 in Millions USD
Adobe	56,128	Location-Based				
Adobe	43,893	Market-Based	-22%	101,400	$ 24.34	$ 25.35
Cisco	651,331	Location-Based				
Cisco	187,428	Market-Based	-71%	430,000	$ 103.20	$ 107.50
Salesforce	281,000	Location-Based				
Salesforce	135,000	Market-Based	-52%	320,000	$ 76.80	$ 80.00
Nvidia	64,940	Location-Based		150,000	$ 36.00	$ 37.50

5.3 CO_2 Data Analysis

This section contains the CO_2 quantitative metrics from the four 2019 Corporate Social Responsibility reports. All of the data originates from the CSR database in Excel as transcribed from the original reports. Quantitative data includes the number of different projects undertaken by each company, the annual revenue and number of employees at each company, and the associated CO_2e for each project.

5.3.1 CO_2 Data Tables, Figures, and Analysis

In this section, each figure will be followed by a brief analysis describing the findings from that figure. Then I will compare the three figures and findings that can be extrapolated about these four companies and the broader information technology industry.

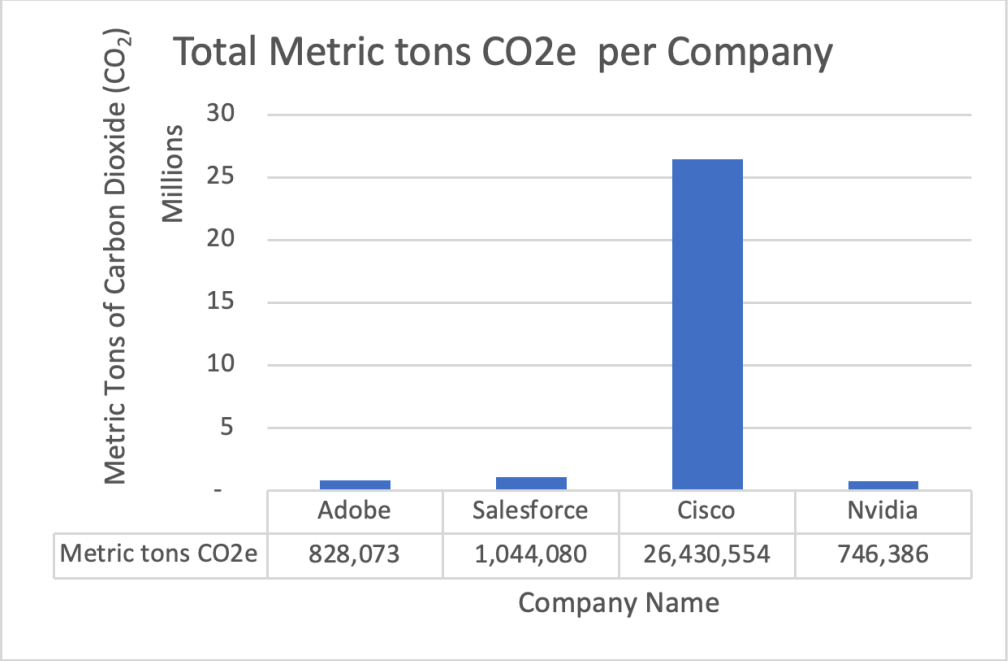


Figure 8: Total metric tons of CO_2e emitted in 2019 for each of the four companies reviewed in this study (Adobe, 2019; Cisco, 2020; Nvidia, 2019; Salesforce, 2019).

Figure 8 displays the total carbon emissions, including energy metrics converted to CO_2e, for all four companies. Cisco emitted 26.4 million metric tons of CO_2e in 2019, over 20 times more

than the next largest emitter, Salesforce at 1.04 million metric tons of CO_2e. Nvidia, Adobe, and Salesforce appear closely grouped together compared to Cisco.

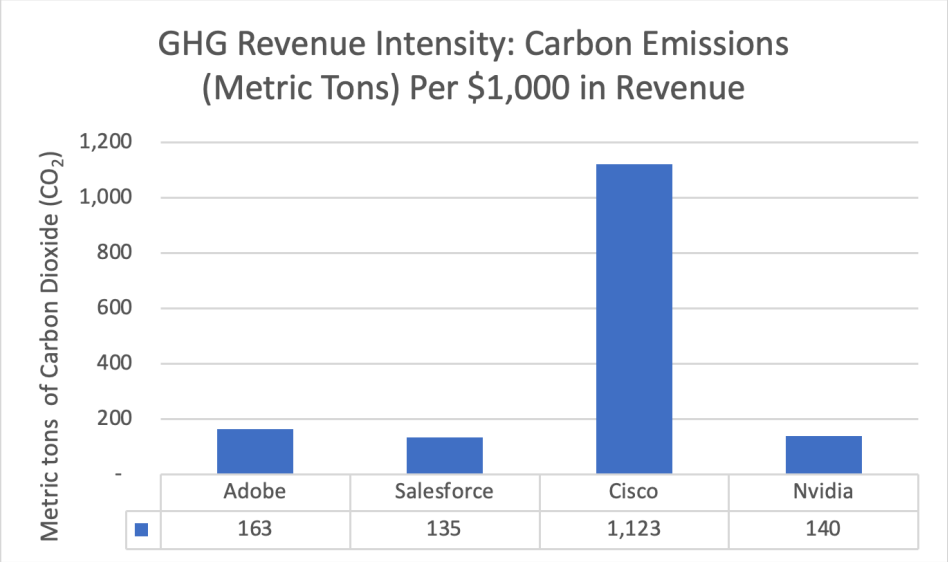


Figure 9: Greenhouse gas intensity calculation displaying metric tons of CO_2e emitted per $1,000 USD in company revenue (Adobe, 2019; Cisco, 2020; Nvidia, 2019; Salesforce, 2019).

In Figure 9, I normalized the carbon emissions data in terms of revenue following the equation in section 5.2.1. Cisco's carbon intensity is much larger than the other three companies. By normalizing the carbon emissions by revenue, I hoped to eliminate company size as a factor in carbon emissions. However, Cisco's persistently larger carbon footprint means that their business practices are markedly different than the other three companies in a meaningful way. To check another way, I also normalized carbon emissions by number the of employees.

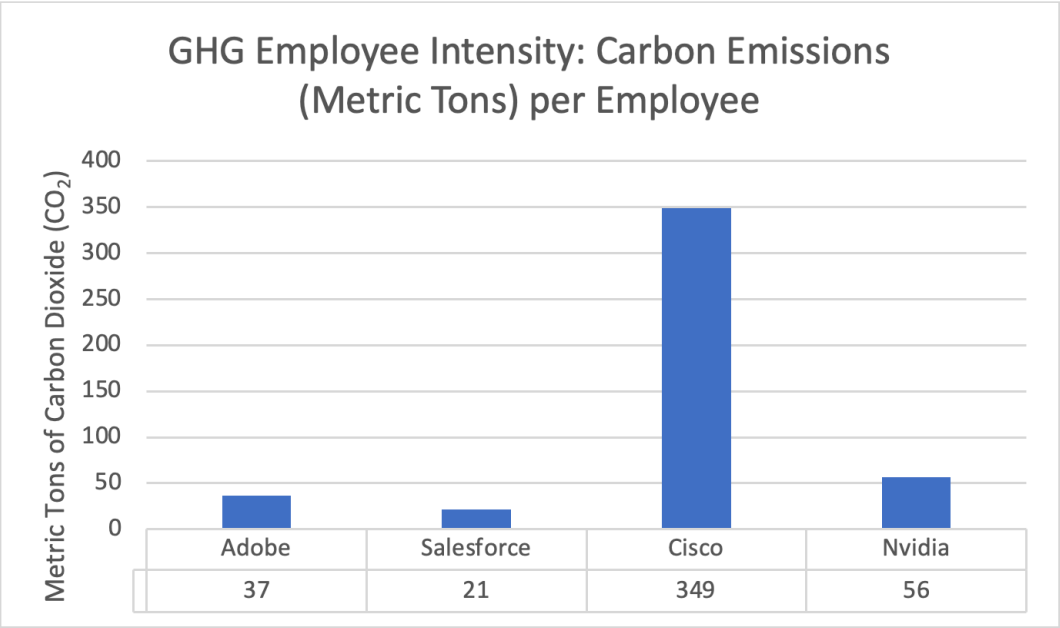


Figure 10: Greenhouse gas intensity calculation displaying metric tons of CO_2e emitted per employee (Adobe, 2019; Cisco, 2020; Nvidia, 2019; Salesforce, 2019).

Again, Cisco's carbon intensity is noticeably larger than the rest of the study group. While this means that there is something different about Cisco's business practices, it also demonstrates an applicable method for comparing other information technology companies. Because each of these three graphs are so similar, there is no clear benefit in reporting carbon intensity in terms of revenue or number of employees. I recommend companies report carbon intensity in terms of revenue because there is less confusion compared to reporting per employee. Companies can count employees in different ways because of part-time workers, contractors, or when FTE is reported instead of headcount. Section 5.2.1 outlines how each of the four companies report this metric.

Table 4: Data used in calculating carbon intensity per revenue and per employee (Adobe, 2019; Cisco, 2020; Nvidia, 2019; Salesforce, 2019).

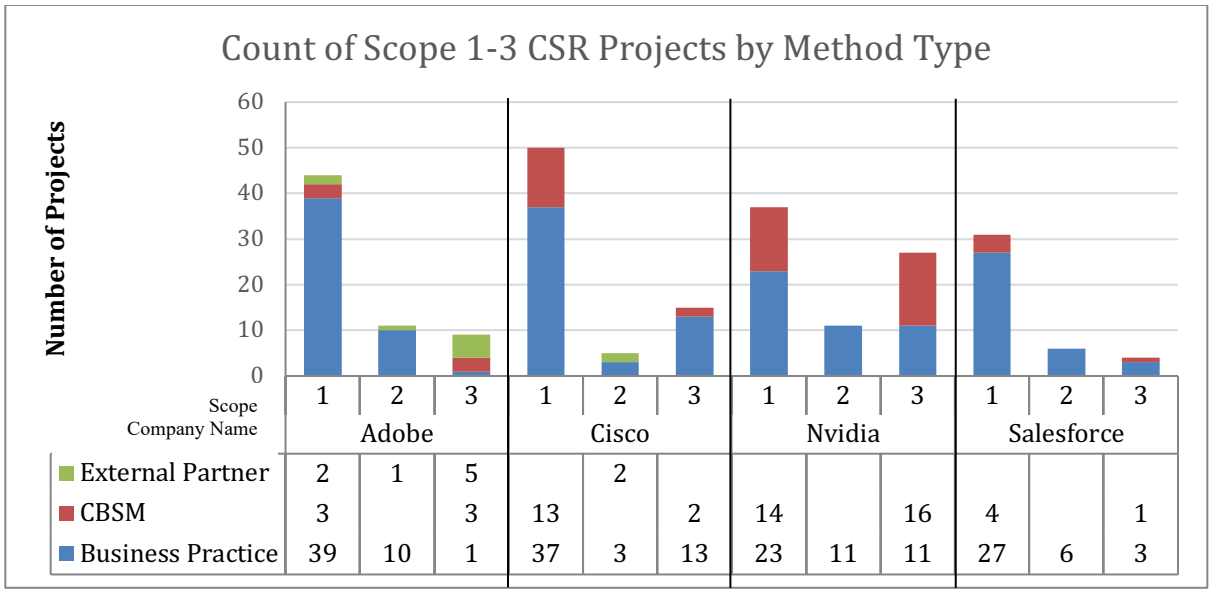
2019 Data	Annual Tons of CO_2 Emitted (metric tons of CO_2)	Annual Revenue ($Billion USD)	Number of Employees	Tons of CO_2 Emitted per $1M Revenue	Tons of CO_2 Emitted per Employee
Adobe	828,073	$11.171	22,634	0.163	36.58
Salesforce	1,044,080	$17.098	49,000	0.135	21.31
Cisco	26,430,554	$51.900	75,762	1.122	348.86
Nvidia	746,358	$2.380	17,346	0.140	56.22

Why is Cisco's carbon footprint so much larger than all of the others? Cisco's material hardware has an outsized impact on its carbon emissions compared to the other three companies in this study. Adobe and Salesforce have no hardware products, and Nvidia produces physically smaller hardware (computer processing cards) and smaller amounts of hardware than Cisco. Hardware and manufacturing are captured in Scope 3 emissions, and Cisco's Scope 3 emissions in Figure 13 show that 99% of Cisco's emissions are Scope 3. The following section 5.4 contains more information about how carbon emissions are broken down by Scope, utility type, and whether the CSR projects addressing the emissions aim to change employee behavior (CBSM) or business practices.

5.4 CSR Projects by Type (Scope 1-3, Utility, CBSM)

This section contains the qualitative metrics from the four 2019 Corporate Social Responsibility reports. All of the data originates from the CSR database in Excel as transcribed from the original reports. Qualitative elements include which Scope of emissions a project addresses, what type of utility it is categorized in, and whether the project aims to change employee behavior or a business process.

5.4.1 Qualitative Data Tables, Figures, and Analysis



Scope	1	2	3	1	2	3	1	2	3	1	2	3
Company Name	Adobe			Cisco			Nvidia			Salesforce		
External Partner	2	1	5		2							
CBSM	3		3	13		2	14		16	4		1
Business Practice	39	10	1	37	3	13	23	11	11	27	6	3

Figure 11: This chart and accompanying data table shows the count of projects in each company's CSR report distributed by whether the project addresses Scope 1, 2, or 3 emissions. Each scope is further broken down by project style: business practice improvement, CBSM employee change, or taken on by an external partner such as a supplier.

Figure 11 displays two different breakdowns of information in one chart: it shows the number of projects each company has to address Scope 1, 2, and 3 emissions, and within each scope of emissions how many are aimed at business process improvements and how many are aimed at changing employee behavior through community based social marketing. Adobe and Cisco also have projects aimed at impacting their external partner suppliers.

Each company has most of its projects within Scope 1 emissions. Scope 1 emissions are fully within the control of the company, so it follows that projects in this category are numerous. Scope 1 projects might be easier to approve than those requiring assistance from third parties and suppliers. Scope 1 projects might cover topics that are more readily noticeable by employees because the emissions originate from the company itself.

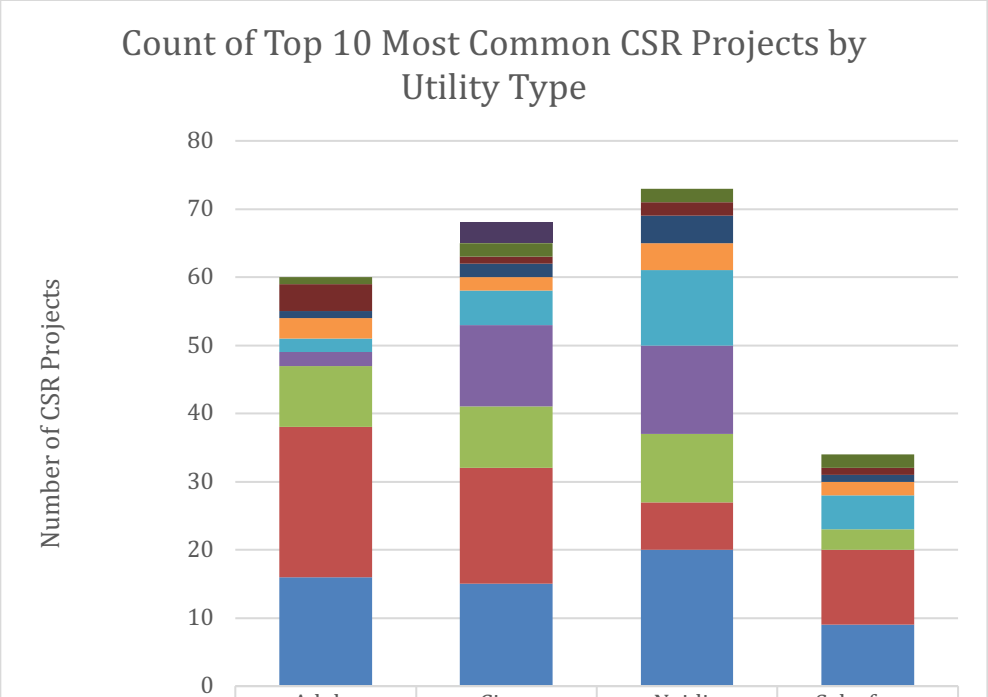
Adobe and Salesforce have very few CBSM projects compared to the other two companies; only seven compared at Adobe and five at Salesforce compared to 15 at Cisco and 30 at Nvidia. In relation to company size and number of employees, Salesforce specifically should have more

environmental programs aimed at their large employee workforce. Nvidia's CBSM projects include many office recycling and composting programs, employee volunteer projects, charitable giving, employee carpooling, onsite electric vehicle charging, and a home solar installation rebate for all employees. Salesforce's relatively smaller offering of CBSM nudges include employee volunteer days, charitable giving, and a sustainability statement in the employee handbook.

There are zero Scope 2 CBSM projects because Scope 2 emissions account for purchased energy, and employees cannot be nudged into entering into an energy purchasing contract with more renewable options and fewer fossil fuels. Because the number of CSR projects available in the Scope 2 space is limited to energy purchasing, in sum the four reviewed companies have the fewest of the projects in Scope 2.

There are energy saving CSR projects in all four companies but they fall under Scope 1 or Scope 3 because they are undertaken by people making choices. For example, Cisco asked office employees to fully shut down their computers over the December holiday vacation period to save energy. This Scope 1 project prevented 3,500 metric tons of CO_2e from being emitted in 2019. For scale, 3,500 metric tons of CO_2e is four times larger than Cisco's annual emissions from business travel. However, 3,500 metric tons of CO_2e is only 0.54% of Cisco's total energy carbon footprint of 651,331 CO_2e.

The prevalence of business process improvements over CBSM style projects demonstrate an environmental commitment across the board for all four companies. By allocating time and financial resources towards improving business processes in an environmentally focused way, these four companies go beyond the public relations motivation of CSR (Wickman, 2014).



	Adobe	Cisco	Nvidia	Salesforce
Transportation		3		
Finance	1	2	2	2
Facilities	4	1	2	1
Suppliers	1	2	4	1
Water	3	2	4	2
SDG	2	5	11	5
Waste	2	12	13	
Employees	9	9	10	3
Energy	22	17	7	11
Emissions	16	15	20	9

Figure 12: Chart and table displaying the top ten most common CSR projects across all four reviewed companies by utility type. The most common projects are at the bottom of the table and chart while the least common are listed at the top of the table and chart.

The top 10 most common "utility" targets of CSR projects in Figure 12 show similarities across all four companies. In this context, I use the term "utility" to refer to actual utilities (e.g., energy, waste, water) and categories of environmental action (e.g., facilities, employees, finance). These utility names organize the CSR Excel database in clear categories of areas of influence. The top three types of projects (emissions, energy, and employees), are identical for all four companies, and waste is the fourth project in kind for three of the four companies. Salesforce does not have any waste management projects, perhaps because Salesforce only has software instead of

physical hardware, or because waste management is built into other projects such as the facilities sustainability.

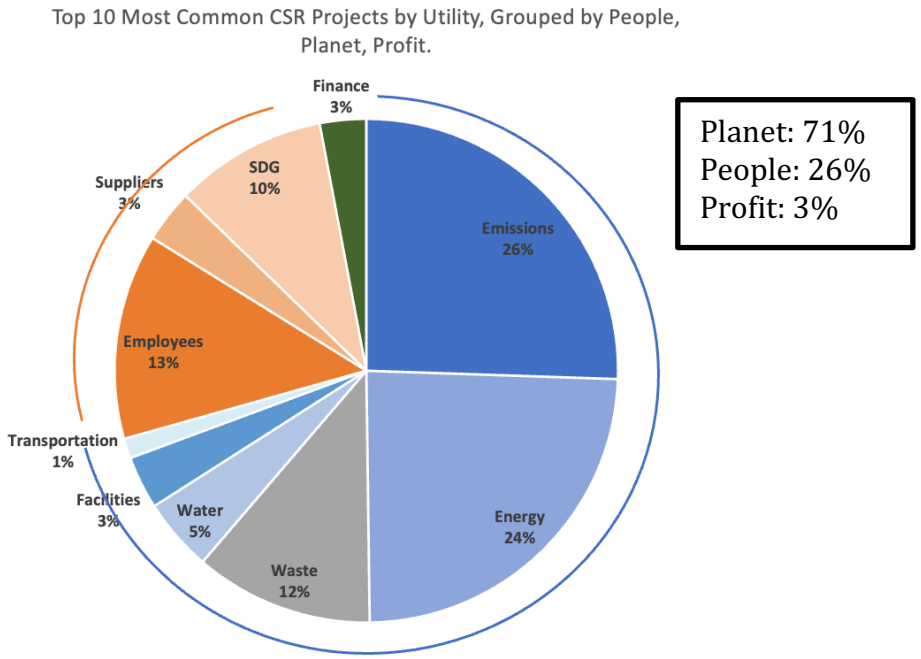


Figure 13: The top ten most common types of CSR projects across all companies in Figure 12 sorted into the three types of CSR objectives (people, planet, profit) from Figure 1.

Based on the number of projects in the three categories of the Triple Bottom Line (people, planet, profit), the four companies in this study heavily favor sustainability projects over those impacting employees or company finances and charitable giving. 71% of all of the CSR projects reported in the four reports relate directly to sustainability. The two largest types of projects, as shown in Figures 12 and 13, are those measuring and reducing carbon emissions and energy use.

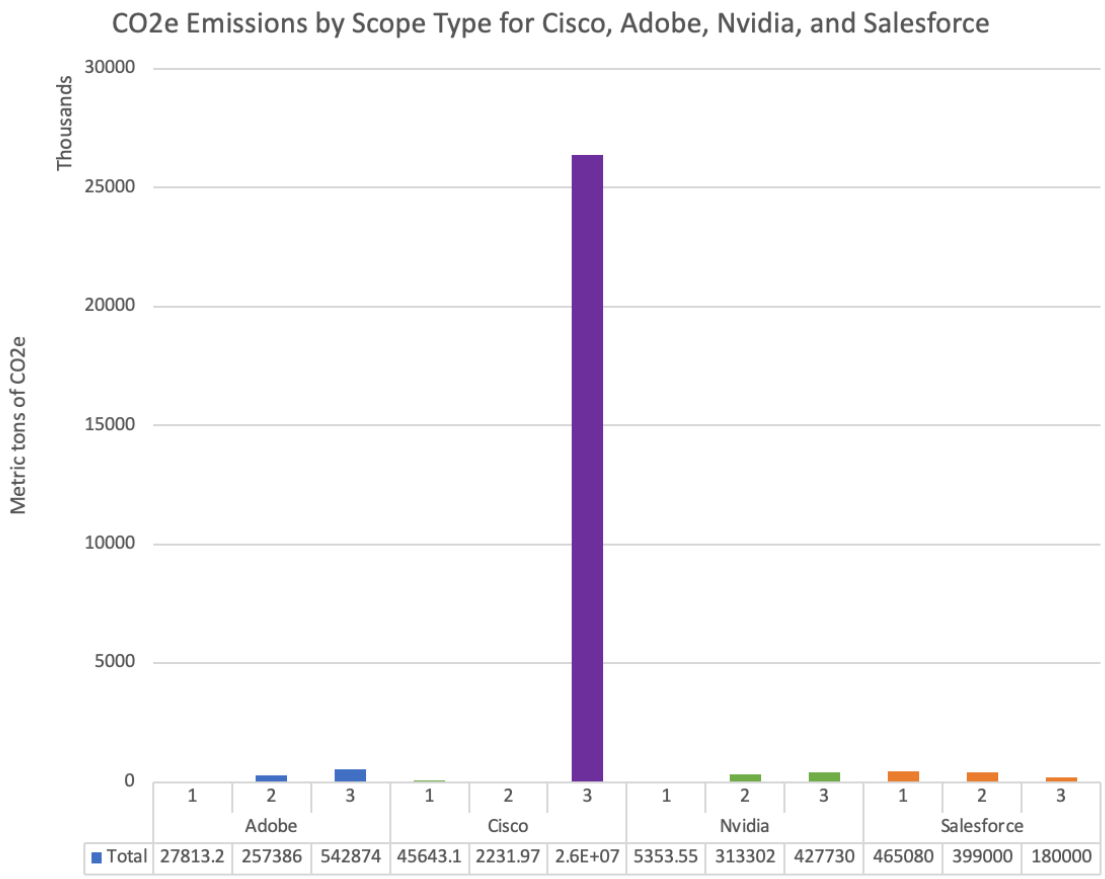


Figure 14: Sum of CO_2 emissions for each Scope across all four companies.

Graphing the carbon footprint of each company has shown that Cisco has an outsized impact in this selection of four companies. To better visualize the carbon emissions coming from each scope, I removed Cisco from Figure 15.

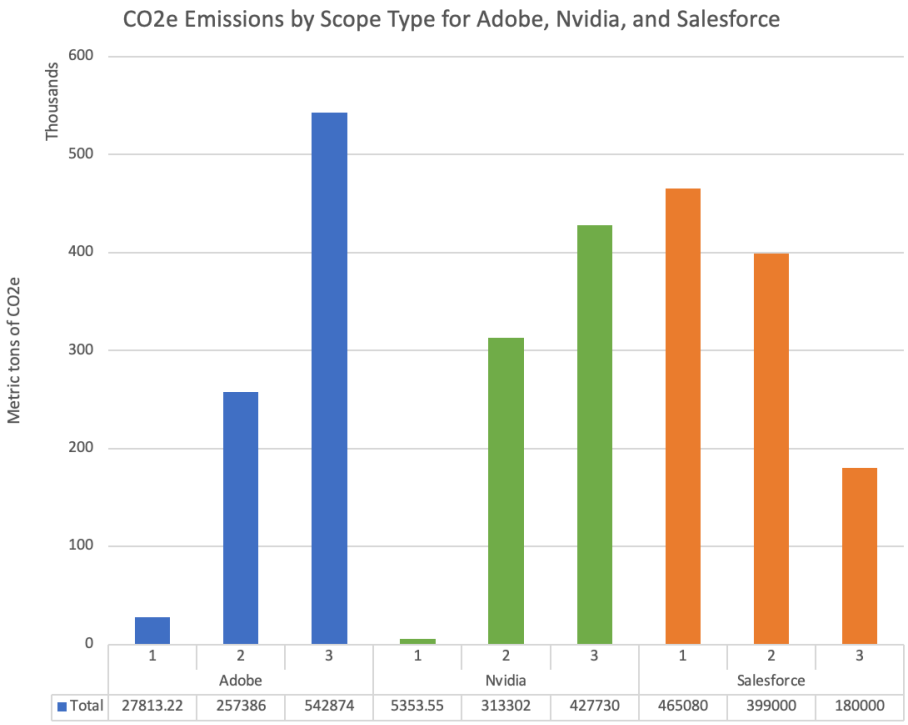


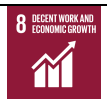
Figure 15: Sum of CO_2 emissions for each scope across three companies: Adobe, Nvidia, and Salesforce.

Looking at Figures 14 and 15 together, three of the companies have most of the carbon emissions in Scope 2 and Scope 3. Only Salesforce has most of its emissions generated in Scope 1. Since a majority of the emissions across these four companies are generated in Scope 2 and 3, why are most of their CSR projects in Scope 1?

5.4.2 United Nations Sustainable Development Goals

The United Nation Sustainable Development Goals outline 17 goals for the future of humanity and the steps needed to reach a better future (Guterres and Zhenmin, 2020). All four of the reviewed companies utilize the Sustainable Development Goals in some way in the CSR reports.

Table 5: The United Nations Sustainable Development Goals addressed in the Corporate Social Responsibility reports of four information technology companies. An "X" denotes that the company has taken on that goal in its business model or through a specific program or product offering.

		Adobe	Cisco	Salesforce	Nvidia
	3: Good Health and Wellbeing				X
	5: Gender Equality				X
	7: Affordable Clean Energy		X	X	X
	8: Decent Work and Economic Growth				X
	9: Industry, Innovation, Infrastructure				X
	11: Sustainable Cities & Communities		X	X	X
	12: Responsible Consumption and Production	X	X	X	
	13: Climate Action	X	X	X	
	14: Life Below Water				X
	15: Life on Land		X	X	X
	Total Goals	2	5	5	8

The United Nations Sustainable Development Goals are a helpful tool for companies to use in its own environmental goal setting because they cover a wide variety of topics and build consensus on important topics highlighted in the international community.

6.0 Management Recommendations

This section contains the management recommendations for all four reviewed companies as well as recommendations for the information technology industry as a whole. The crux of all of these recommendations center on building sustainability into the core business model for each organization. The categories of recommendations are energy related, policy and legislative actions, and physical product longevity.

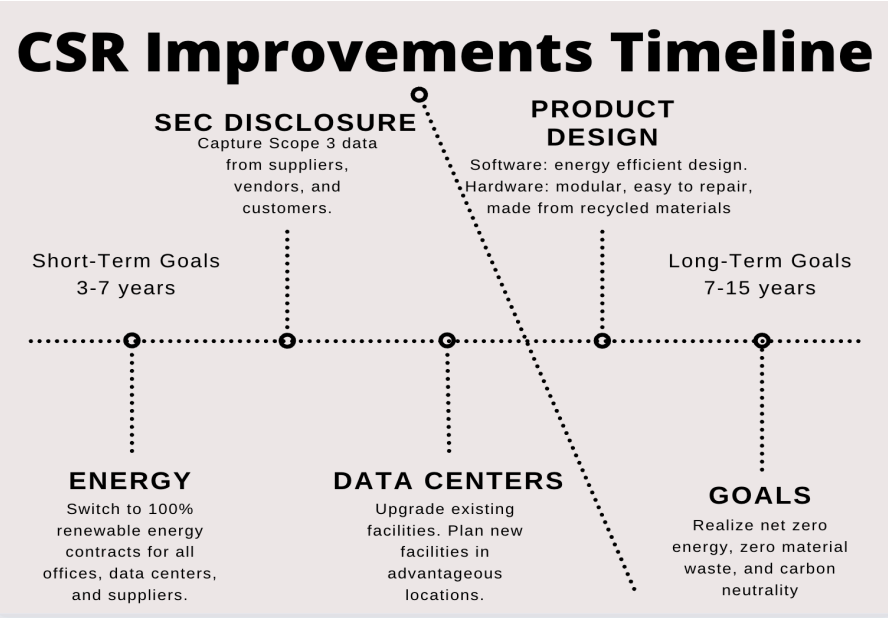


Figure 16: A proposed timeline of Corporate Social Responsibility program improvements in two phases, 3-7 years and 7-15 years. Timeline graphic designed by the author.

The management recommendations summary timeline in Figure 12 offers a two-phase approach to improving sustainability outcomes and the actual CSR reports. The first phase of 3-7 years calls for switching all operations and suppliers to 100% renewable energy sources, preparing for the new SEC carbon emissions disclosure rules, and increasing energy efficiency at existing data centers while planning for future expansions. The second phase of 7-15 years recommends

product software and hardware redesigns with sustainability best practices in mind, and finally the realization of lofty goals like net zero energy, zero waste, and carbon neutrality. These all-encompassing goals are often set by corporations to inspire action at all levels of the company. In this paper and in these reviewed companies, the United Nations Sustainable Development Goals take the place of these goals.

6.1 Energy

One of the most immediate changes that any of these four companies can make is improving its energy mix by including more renewable sources of energy, including energy generation onsite. Improving energy efficiency in business practices has an outsized long-lasting impact on the companies' carbon emissions footprint.

6.1.1 Energy Efficiency

Software design can and should include best practices in engineering to increase software energy efficiency. Software energy efficiency needs to be included in design key performance indicators alongside functionality, reliability, and security. One way to track software energy efficiency is by kWh of electricity used per function (Calero, 2019). Choosing to design software to use less energy and take up less digital space can decrease carbon emissions per use of that piece of software. Taking up less digital space also reduces the impact at the data center level. For example, Salesforce tracks and reports its online platform performance from an energy perspective. Salesforces' platform performance unit is even converted into equivalent units of CO_2e and reports it as CUE or Carbon Unit Effectiveness. Nvidia developed computer servers that run Nvidia graphics cards using less physical and digital storage space while also consuming less power than previous computer servers (Nvidia, 2019).

6.1.2 Data Centers

Nvidia's high performing computer processing chips, cards, and data servers are one way that companies can cut down on computing power to save energy. Companies must consider the impact of cloud computing and data centers when tabulating and sharing out energy efficiency information on its software products. Existing data centers should be retrofitted for the best available technology in air conditioning including server stack design techniques like the

hot/cold aisle method. New data centers should also use the best available technology and should be located in areas that support energy efficiency. As listed in Table 2, locations with naturally cold climates, naturally wet climates, and areas well suited for renewable energy, are all preferable.

6.2 Energy Policy and Legislative Actions

Improvements and additions to public policy legislation will have an immediate effect on the entire industry, but policy changes require governmental consensus and they need to survive possible legal attacks. External assurance programs such as the Global Reporting Initiative improve CSR reports by providing frameworks, standards, common terms, and customization (Maroun, 2019). Policy has been a less important driver of CSR reporting elements or quality compared to other external drivers such as shareholder activism and public relations perceptions. Stronger external drivers include international and intergovernmental goals like the United Nations Sustainable Development Goals that set trends and impact business processes. Also, local governments act as drivers by impacting renewable energy availability. Recently the United States Securities and Exchange Commission proposed carbon disclosures that impact businesses through the financial sector, and pending legislation in the areas of Right to Repair impact how corporations conduct Corporate Social Responsibility.

6.2.1 SEC Disclosure Requirements

The Securities and Exchange Commission (SEC) is the governing body tasked with oversight for the United States' financial markets. The SEC can create and set rules that must be followed by American companies and banks, and the SEC has an investigating and enforcement ability with which to provide follow-through. In March 2022, the SEC announced a first of its kind carbon disclosure requirement (Countryman, 2022). The proposed rule aims to increase transparency and give stockholders more information related to climate change and its impact on the business. In a similar methodology in this report to how I convert multiple environmental metrics into a common unit, CO_2e, the SEC requests that companies report greenhouse gas emissions as the primary metric. In the SEC's Proposed Rule document, they reiterate that under the current system, investors "cannot obtain the consistent, comparable, and material information" related to climate-related risks and environmental social governance (Countryman, 2022).

The proposed SEC rule requires disclosure of Scope 1, 2, and 3 emissions. Because of the additional challenges of accurately reporting Scope 3 emissions, the SEC proposes offering a reprieve from liability, an exemption for small emitters, and a delay in rolling out Scope 3 requirements for several years. Scope 3 emissions are harder to accurately report because the reporting company must rely on outside sources of information and the company must make assumptions about the end-of-life of the product once it is in customer hands. The SEC has demonstrated its understanding of the importance of full information reporting by requesting Scope 3 emissions.

What would make the SEC proposed rule even more impactful is a set of standardized industry key performance indicators so that companies can have benchmark measurements to aim for when setting their goals. Based on my analysis of comparing carbon emissions per revenue and per employee, I recommend that the SEC normalize carbon emissions on a per revenue basis. I also recommend that they set industry benchmarks of carbon intensity per revenue for hardware and software companies. This will set a range of expected carbon intensity that will help companies to know if they are on track or exceeding normal carbon emissions in their industry peer group. Under the current practice of voluntary reporting and various reporting frameworks this comparison is nearly impossible.

In addition to reporting greenhouse gas and other environmental metrics, companies must report climate-related risks to core business operations. For example, Cisco operates out of 20 buildings in San Jose all within five miles of the San Francisco Bay. As climate change causes sea level rise in the San Francisco Bay, Cisco's office buildings are in danger of flooding and Cisco will have to report that to the SEC. Figure 17 shows one such office in danger of flooding under conditions of two feet in sea level rise.

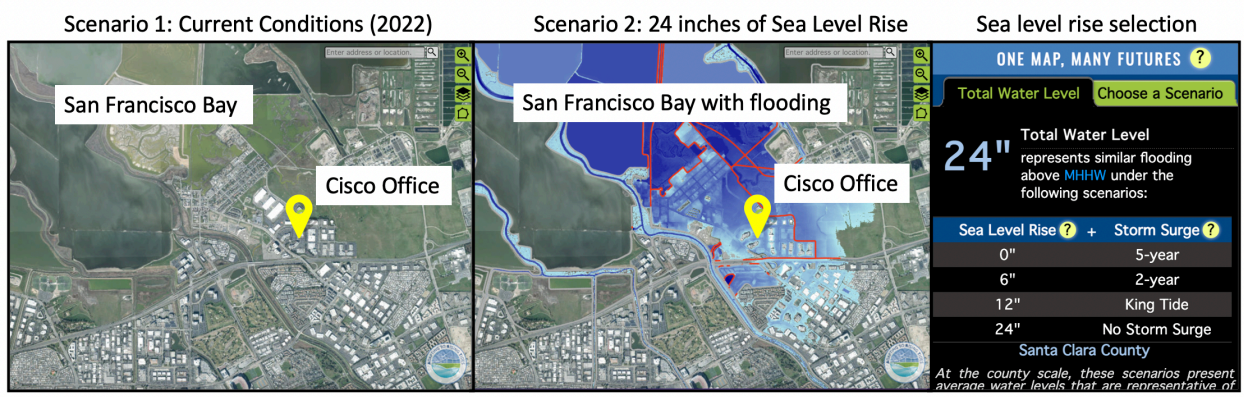


Figure 17: ART Bay Area Sea Level Rise and Shoreline Analysis map showing Cisco's Nortech office building under normal conditions compared to 24 inches of sea level rise in San Jose, CA. Topographic map sea level rise data are from FEMA and San Francisco Estuary Institute (San Francisco Bay Conservation and Development Commission, 2022).

6.3 Physical Product Longevity

The embodied carbon in physical products from Cisco and Nvidia are a major source of overall carbon emissions. To maximize the use of these products and subsequently maximize the embodied carbon, the physical products need to be durable, long-lasting, adaptable to software updates, and repairable. Utilizing the same product for a longer amount of time rather than replacing the product reduces the need to extract raw materials and manufacture a whole new product.

6.3.1 Embodied Carbon: Upstream Supply Chain

The manufacturing of materials and products are major components of Scope 3 emissions for Cisco and Nvidia. Manufacturing activities conducted by third-party suppliers are categorized as Scope 3 because they are not directly emitted by the company. These upstream emissions can be mitigated or reduced through supply chain management practices. I recommend utilizing recycled materials, require a supplier code of conduct, reduce transportation of materials, and design products for longevity and end-of-life recycling

Using post-consumer recycled materials in the manufacturing of new products has many environmental benefits including reducing the need to extract raw materials, reducing

transportation miles of materials, and supporting the supply-side of the recycling industry as well as the circular economy. None of the four companies expressly say whether or not recycled materials are used in manufacturing. Cisco's telecommunications and networking physical products are made of plastic and metal components. Metals are particularly well suited for recycling because they can be remanufactured with minimal loss of material integrity. Recycling plastic reduces the need for extraction of fossil fuels and the creation of petrochemicals.

Physical product design directly impacts product longevity, modularity, and end-of-life use. Designing products for modularity and flexibility increases longevity and therefore reduces the need for more new replacement products and new carbon emissions. Cisco especially should design its products such that broken parts can be easily replaced or repaired. Modularity and compatibility in this sense refers to the suite of a product's ability to work with each other so that when one piece of a system gets upgraded the rest of the system can remain. For example, Nvidia's graphics cards are built to run specific software. Can the same card be updated to run newer software to prolong product longevity?

A supplier code of conduct can help companies select supply chain partners that prioritize sustainability, support CSR goals, and reduce Scope 3 emissions. Three of the companies in this study use the Responsible Business Alliance, an electronics industry coalition that provides a code of conduct framework and auditing tools for sustainability and ethics. Adobe requires 100% of suppliers comply with the Responsible Business Alliance. Cisco helped to found the Responsible Business Alliance and uses its auditing process to assess the Cisco supply chain. Nvidia as a company complies with the Responsible Business Alliance when they act as a supplier of computer graphics cards and other products. Nvidia uses ISO14001 rather than Responsible Business Alliance when auditing and assessing its supply chain partners. ISO14001 requires companies to have an environmental management system in place using its set of environmental standards. Salesforce has its own supplier code of conduct and it is unclear what the auditing process entails from a sustainability standpoint. I recommend Salesforce join with its peers and require its suppliers comply with Responsible Business Alliance standards. This will help the company to select suppliers that prioritize sustainability and support Salesforce's CSR goals.

Reducing transportation miles and centralizing manufacturing can reduce Scope 3 supply chain emissions and increase business process efficiencies. Cisco completed a goal of removing one million tons of greenhouse gas emissions from its supply chain. Cisco completed this goal in part by shifting its transportation of materials from air to oceanic freight, and by consolidating trucking shipping to customers.

Once the products have reached the end of its useful life, what options are available for either prolonging the life of the product through repair or ultimately disposing of the product?

6.3.2 Embodied Carbon: Downstream Right to Repair

In order to increase the amount of time that a physical product can be in use, the product needs to be repairable when it breaks. The manufacturing company may have its own repair operations or customers might be able to go to a third-party repair business, or even repair the product themselves. The ability to take a product to a third-party repair specialist is known as the right to repair. Companies can support the right to repair movement by prioritizing design best practices including piece modularity, selling replacement parts, using removable screws instead of permanent glues, and omitting the need to use proprietary tools.

For example, Apple products like the iPhone are purposefully difficult to repair at home or through third-party specialists because the body of the phone is screwed shut using an Apple brand-specific five lobed security screw (Wiens, 2011). This screw can only be removed using a specialized “pentalobe” screwdriver rather than a standard flathead or Phillips’s head screwdriver. The unique screw shape requires product owners to utilize Apple’s own repair services which discourages cheaper at-home repairs. Similarly, the MacBook Pro computer batteries are glued to the body of the device using an industrial strength adhesive, making it nearly impossible for an at-home individual to remove and replace a new battery without damaging the product or harming themselves.

Right to repair legislation is pending in several states and has united diverse industries including technology, agriculture, and medical services. Companies can support right to repair without

government intervention by utilizing best practices in design and access to replacement parts. Legislative requirements would level the playing field by asking all product manufacturers to comply with these best practices. The key components of right to repair legislation in the information technology industry are: (1) access to information such as user manuals and product schemas, (2) design practices that prioritize modularity and part replacement, (3) the use of removable parts rather than permanent adhesives, (4) removing proprietary and non-standardized pieces, and (5) permission to fix a product at home or through a third-party service without voiding the product warranty (Svensson-Hoglund et al., 2021).

Cisco and Nvidia can support right to repair and product longevity by following the above best practices for all of its physical products. Cisco is in a particularly optimal situation because it can send virtual upgrades to its physical products to keep them up to date for longer amounts of time. As of the 2019 Cisco CSR report, Cisco partners with six repair centers globally that have repaired over 1 million “units” of hardware to date. The CSR also highlights Cisco’s Design for Environment program with principles including reducing hazardous materials, design for longevity, and energy efficiency.

Nvidia’s graphics cards are harder to update because each card contains hardware for specific software capabilities. However, Nvidia can take advantage of appropriate electronic waste recycling efforts to reduce its downstream carbon emissions. Nvidia’s 2019 CSR report mentions repair one time: in its transportation logistics goals, stating that it aims to support regional repair centers to reduce international shipping.

7.0 Conclusion

The primary stated goal of a for-profit company is to be profitable, but Corporate Social Responsibility projects raise the importance of considering and executing for the good of people and the environment. The current status of CSR reporting in the information technology industry shows an array of acceptable types of reporting frameworks and methodologies, but a lack of consistency or comparability between companies, and few key indicators with which to indicate success or failure. Upcoming carbon disclosure requirements originating from financial regulators may be the solution to the generally unorganized and voluntary CSR reporting system.

To be truly sustainable, companies need to go against the prevailing economic forces dictating constant growth. Can these companies grow while selling fewer physical products because those products stay in use longer? Can they expand their data center footprints in ways that enhance the transition to clean energy? The focus on emissions, energy, and employees across all four reviewed companies demonstrate that corporate focus is on those most impactful topics.

What is needed now are carbon emissions disclosure standards to standardize reporting across all industries, and clear incentives for emissions reductions. Voluntary CSR reports are driven by a company's desire to appeal to customers and shareholders from an environmental perspective. Saving money, innovating, and reducing contributions to greenhouse gas emissions are side effects of CSR activities.

All four of these companies have shown real change to their core business models in an effort to improve the way that business is done while reducing environmental impacts. These successes should be better codified so that they can be replicated throughout the information technology industry and beyond. This is especially true for manufacturers of technology products, since those have a much larger carbon footprint than software products.

Using guideposts like the United Nations Sustainable Development Goals, frameworks provided by the Global Reporting Initiative, and following regulatory requirements from the SEC, the information technology industry and other business sectors have all the tools required to make significant improvements to their Corporate Social Responsibility projects and reports. In conclusion, improving sustainable business practices is just the right thing to do, which through accurate corporate social responsibility reporting, will attract customers and business opportunities for the long-term success of these companies and the environment.

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Appendices

Appendix 1: Corporate Social Responsibility 2019 Report Database for Adobe, Cisco, Salesforce, and Nvidia.

Natalie Calhoun University of San Francisco Masters Project 2022: Corporate Social Responsibility Database

Company Name	Project Name	Utility	Metric	Units	Goal/Aim	Scope	Document	Notes	Biz Practice or CBSM	Notes II
Adobe	Women & POC on Board	Governance	45%	%	% of Women and POC on Board	1	Adobe CSR Report 2019	45% of board is women & poc	Business Practice	
Adobe	Employee Diversity	Employees	#8 ranking	ranking	Diversity ranking	1	Adobe CSR Report 2019	#8 on Fortune's Best Workplace for Diversity	Business Practice	22,632 employees at Adobe
Adobe	Employee CSR Participation	Employees	70%	%	Employee CSR participation	1	Adobe CSR Report 2019		CBSM	
Adobe	Employee CSR Participation	Employees	60,000	# of employees	# of organizations served	1	Adobe CSR Report 2019		CBSM	
Adobe	Employee CSR Participation	Employees	$49,100,000	$	Charitable Giving	1	Adobe CSR Report 2019		CBSM	
Adobe	Renewable Electricity	Energy	4x increase	n/a	renewable electricity deployed	2	Adobe CSR Report 2019		Business Practice	
Adobe	Scope 1 & 2 Market-Based Emissions	Energy	7.10%	%	reduce market-based emissions	2	Adobe CSR Report 2019		Business Practice	
Adobe	RE100	Energy	Member	n/a	Membership in organization	1	Adobe CSR Report 2019	https://www.there100.org/re100-members	Business Practice	
Adobe	Science Based Target initiatives	Energy	Member	n/a	Membership in organization	1	Adobe CSR Report 2019	https://blog.adobe.com/en/2018/04/20/businesses-need-collaborate-sustainable-future	Business Practice	
Adobe	Resource Saver Calculator	Product	n/a	n/a	help customers reduce paper usage	3	Adobe CSR Report 2019	https://acrobatusers.com/resource-saver-calculator/	Business Practice	
Adobe	Energy Intensity	Energy	21%	%	reduction in energy use intensity across Adobe workspaces from FY17	1	Adobe CSR Report 2019		Business Practice	
Adobe	Renewable Electricity	Energy	4x increase	n/a	more renewable electricty w/o offsets b/w 2018-2019	1	Adobe CSR Report 2019		Business Practice	
Adobe	Women Employees	Employees	33%	%	33% of employees are women	1	Adobe CSR Report 2019		Business Practice	
Adobe	BIPOC Employees	Employees	10%	%	10% of employees are BIPOC	1	Adobe CSR Report 2019		Business Practice	
Adobe	Gender Pay Parity	Employees	1:01	ratio	women are paid the same as men	1	Adobe CSR Report 2019		Business Practice	
Adobe	Total Revenue	Finance	$11,171,000,000	$	2019 Total Revenue	1	Adobe CSR Report 2019		Business Practice	
Adobe	Women on Board	Governance	27%	%	% of Women and POC on Board	1	Adobe CSR Report 2019		Business Practice	
Adobe	Total Employees	Employees	22,634	# of employees	Total number of Employees	1	Adobe CSR Report 2019		Business Practice	
Adobe	Total Workspace	Facilities	4,685,530	square foot	Total square footage worldwide offices	1	Adobe CSR Report 2019		Business Practice	
Adobe	Leed Green-Certified Buildings (Owned & Leased)	Facilities	75%	%	Leed Green-Certified Building space	1	Adobe CSR Report 2019		Business Practice	
Adobe	Leed Green-Certified Buildings (Owned Only)	Facilities	61%	%	Leed Green-Certified Building space	1	Adobe CSR Report 2019		Business Practice	
Adobe	Leed Green-Certified Buildings (Leased Only)	Facilities	46%	%	Leed Green-Certified Building space	2	Adobe CSR Report 2019		Business Practice	
Adobe	CDP Score	General	A	score	Overal sustainability rating	1	Adobe CSR Report 2019	https://www.rio.ai/blog/making-the-cdp-a-list-your-guide-to-cdp-reporting#:~:text=What%20is%20a%20CDP%20score,are%20calculated%20using%20questionnaire%20responses.	Business Practice	
Adobe	Total Energy Consumption	Energy	221,486	MWh	Total Energy Consumption	1	Adobe CSR Report 2019		Business Practice	
Adobe	Total Energy Consumption	Energy	797,351	GJ	Total Energy Consumption	1	Adobe CSR Report 2019		Business Practice	
Adobe	Grid Electricity	Energy	71%	%	% of total energy consumed that is grid electricity	1	Adobe CSR Report 2019		Business Practice	
Adobe	Renewable Energy	Energy	25%	%	% of total energy consumed that is renewable	1	Adobe CSR Report 2019		Business Practice	
Adobe	Renewable Electricity	Energy	34.90%	%	% of total electricity consumption that is renewable electricity	1	Adobe CSR Report 2019		Business Practice	
Adobe	Global Grid Electricity Purchased and Consumed	Energy	159,277	MWh	global grid energy purchased and consumed	1	Adobe CSR Report 2019		Business Practice	
Adobe	Data Center Energy	Energy	21%	%	% of electricity purchased and consumed from Managed data centers	1	Adobe CSR Report 2019		Business Practice	
Adobe	Global Fuel (Natural Gas & Deissel/Oil) purchased	Energy	62,210	MWh	Natural Gas & Oil	1	Adobe CSR Report 2019		Business Practice	
Adobe	Fuel Cell Electricity Produced	Energy	11,230	MWh	Fuel Cell Electricity produced	1	Adobe CSR Report 2019		Business Practice	
Adobe	% Fuel Cell Electricity Produced On-Site	Energy	7%	%	Fuel Cell Electricity produced onsite	1	Adobe CSR Report 2019		Business Practice	
Adobe	Workspace Total Energy Use (exclude Managed COLO Energy?)	Energy	186,894	MWh	Workplace Energy (excluding managed COLO)	1	Adobe CSR Report 2019		Business Practice	
Adobe	Energy Intensity Workplaces	Energy	0.0399	MWh/sqare foot	Workplace Energy Intensity	1	Adobe CSR Report 2019		Business Practice	
Adobe	EV Drivers	Employees	24%	%	% of employees US who drive an EV to work	3	Adobe CSR Report 2019		CBSM	
Adobe	Scope 1 GHG Emissions	Emissions	11,817	Tonnes CO2e	Tonnes of CO2e	1	Adobe CSR Report 2019		Business Practice	
Adobe	Scope 1 GHG Emissions (natural cas, diesel, LPG)	Emissions	10,855	Tonnes CO2e	Tonnes of CO2e	1	Adobe CSR Report 2019		Business Practice	
Adobe	Scope 1 GHG Emissions (fuel cells)	Emissions	4,611	Tonnes CO2e	Tonnes of CO2e	1	Adobe CSR Report 2019		Business Practice	
Adobe	Scope 2 GHG Emissions, location-based	Emissions	56,128	Tonnes CO2e	Tonnes of CO2e	2	Adobe CSR Report 2019		Business Practice	
Adobe	Scope 2 GHG Emissions (Managed Collocated Data Centers)	Emissions	10,870	Tonnes CO2e	Tonnes of CO2e	2	Adobe CSR Report 2019		Business Practice	
Adobe	Scope 2 GHG Emissions, market-based	Emissions	43,893	Tonnes CO2e	Tonnes of CO2e	2	Adobe CSR Report 2019		Business Practice	
Adobe	Scope 3 GHG Emissions	Emissions	542,874	Tonnes CO2e	Tonnes of CO2e	3	Adobe CSR Report 2019		External Partner	
Adobe	Scope 3 GHG Emissions from purchased goods & services	Emissions	358,472	Tonnes CO2e	Tonnes of CO2e	3	Adobe CSR Report 2019		External Partner	
Adobe	Scope 3 GHG Emissions from Capital Goods	Emissions	39,706	Tonnes CO2e	Tonnes of CO2e	3	Adobe CSR Report 2019		External Partner	
Adobe	Scope 3 GHG Emissions FERA	Emissions	14,180	Tonnes CO2e	Tonnes of CO2e	3	Adobe CSR Report 2019		External Partner	
Adobe	Scope 3 GHG Emissions from upstream transportation & distribution	Emissions	739	Tonnes CO2e	Tonnes of CO2e	3	Adobe CSR Report 2019		External Partner	
Adobe	Scope 3 GHG Emissions Employee Travel	Emissions	88,959	Tonnes CO2e	Tonnes of CO2e	3	Adobe CSR Report 2019		CBSM	
Adobe	Scope 3 GHG Emissions Employee Commuting	Emissions	42,037	Tonnes CO2e	Tonnes of CO2e	3	Adobe CSR Report 2019		CBSM	
Adobe	Emissions Reductions from Energy Efficiency Projects	Emissions	143	Tonnes CO2e	Tonnes of CO2e	1	Adobe CSR Report 2019		Business Practice	
Adobe	Emissions of Ozone-Depleting substances	Emissions	486	Tonnes	Tonnes of Ozone-depleting substances	1	Adobe CSR Report 2019		Business Practice	

Adobe	Normalized Carbon Intensity	Emissions	3	(Tonnes CO2e (Scope1+2)/FTE)	(Tonnes CO2e(Scope1+2)/FTE)	1	Adobe CSR Report 2019	This could be a useful calculation to use in comparison to other companies. Can I include workspace sqft into this somehow?	Business Practice	
Adobe	Total Water Consumption (US & India Owned/Managed Facilities)	Water	262,045	cubic meters	cubic meters of water usage	1	Adobe CSR Report 2019		Business Practice	
Adobe	Water Recycling	Water	15.40%	%	% of total water recycled	1	Adobe CSR Report 2019		Business Practice	
Adobe	Water in Drought Areas	Water	42%	%	% of water in regions with High or Extremely High Baseline Water Stress	1	Adobe CSR Report 2019	High = 33%. Extremely High = 9%	Business Practice	
Adobe	Waste Diversion	Waste	1,652	Short tons	Waste diverted from global owned/managed facilities	1	Adobe CSR Report 2019	I'm guessing it's diverted from landfill?	Business Practice	
Adobe	Waste Diversion	Waste	92%	%	Waste diversion rate from total	1	Adobe CSR Report 2019	This seems really high	Business Practice	
Adobe	Data Center Energy (Adobe owned Hillsboro, OR)	Energy	15,368	Metric tonnes CO2e	Metric tonnes co2e	2	Adobe CSR Report 2019	https://www.adobe.com/corporate-responsibility/sustainability/data-centers.html	Business Practice	
Adobe	Data Center Energy purchased and consumed from Adobe-owned data center in Hillsboro, OR	Energy	51,695	MWh	Energy purchased Mwh	2	Adobe CSR Report 2019	https://www.adobe.com/corporate-responsibility/sustainability/data-centers.html	Business Practice	
Adobe	Data center energy GHG emissions from Collocated Data Centers	Energy	10,870	Metric tonnes CO2e	Metric tonnes co2e	2	Adobe CSR Report 2019	https://www.adobe.com/corporate-responsibility/sustainability/data-centers.html	Business Practice	
Adobe	Data Center Energy purchased and consumed from Collocated Data Centers	Energy	32,831	MWh	Energy purchased Mwh	2	Adobe CSR Report 2019	https://www.adobe.com/corporate-responsibility/sustainability/data-centers.html	Business Practice	
Adobe	Supplier Code of Ethics & Sustainability	Suppliers	100%	%	% of suppliers required to comply with RBA	2	Adobe CSR Report 2019	https://materion.com/about/environmental-social-and-governance/our-operations/rba-compliance#:~:text=The%20RBA%20Code%20of%20Conduct,the%20electronics%20industry%20supply%20chain.	External Partner	
Adobe	Responsible Consumption and Production	SDG	Set Goal	n/a	#12 Ensure sustainable consumption and production patterns	1	Adobe CSR Report 2019		External Partner	
Adobe	Climate Action	SDG	Set Goal	n/a	#13 Climate Action	1	Adobe CSR Report 2019		External Partner	
Cisco	Supply Chain GHG Emission Reduction	Emissions	115%	%	Goal to avoid 1 million metric tonnes of GHG emissions from supply chain. Goal met 115%	2	Cisco CSR 2019	Success attributed to smart supply chain decisions	External Partner	
Cisco	No Paint Project	Waste	100%	cans of paint	Elimination of oil-based paints on Catalyst 9200 and 9300L products.	1	Cisco CSR 2019	increased recyclability, reduced GHG emissions, and eliminated VOCs	Business Practice	
Cisco	Recycled Plastic	Waste	456	metric tonnes virgin plastic	plastic avoided (reduced)	1	Cisco CSR 2019		Business Practice	
Cisco	Reusable Pallet Wraps	Waste	79,000	pounds of plastic	eliminate plastic cling film	1	Cisco CSR 2019	single-use replaced with reusables	Business Practice	
Cisco	Energy Mix	Energy	100%	%	US facilities are already powered by 100% renewable energy	1	Cisco CSR 2019		Business Practice	
Cisco	Employee Metrics	Employees	75,762.00	# of employees	Number of employees	1	Cisco CSR 2019		Business Practice	
Cisco	Revenue	Finance	$51,900,000,000	$	FY2019 Revenue	1	Cisco CSR 2019		Business Practice	
Cisco	CSR Governance	Governance	n/a	Board of Directors	Cisco CSR Board of Directors	1	Cisco CSR 2019	Figure 2, page 26	Business Practice	
Cisco	IT Solutions for the Environment	SDG	n/a	SDG	#11 Sustainable Cities and Communities	3	Cisco CSR 2019	products that promote environmental benefits	Business Practice	
Cisco	Energy & GHG	SDG	n/a	SDG	#7 Affordable and Clean Energy	3	Cisco CSR 2019	energy efficiency, renewable energy purchases, product energy efficiency	Business Practice	Cisco Target 7.2 & 7.3
Cisco	Energy & GHG	SDG	n/a	SDG	#13 Climate Action	3	Cisco CSR 2019	energy efficiency, renewable energy purchases, product energy efficiency	Business Practice	Cisco Target 13.2.1 & 13.3
Cisco	Energy & GHG	SDG	n/a	SDG	#15 Life on Land	3	Cisco CSR 2019	energy efficiency, renewable energy purchases, product energy efficiency	Business Practice	Cisco Target 15.5 & 15.7
Cisco	Material use & waste	SDG	n/a	SDG	#12 Responsible Consumption and Production	1	Cisco CSR 2019	circular economy, end-of-life programs, use of recyclable materials	Business Practice	Cisco Target 12.2, 12.4, 12.5, 12.6, 12.7
Cisco	CDP Score	General	A	Score	Carbon Disclosure Project Score	1	Cisco CSR 2019		Business Practice	
Cisco	Women & POC on Board	Employees	62%	%	Executive Leadership who are women or poc	1	Cisco CSR 2019		CBSM	
Cisco	Green Team Network	Employees	Yes	n/a	They maintain a Green Team Network	1	Cisco CSR 2019	11 chapters and hundreds of members.	CBSM	All the projects are CBSM: waste sorting, eliminate paper cups, urban farm on campus, etc.
Cisco	Employee CSR Participation	Employees	447,935	hours	Total employee hours volunteered	1	Cisco CSR 2019		CBSM	
Cisco	Donation	Finance	$25,500,000	$	total donated to charities by employees/match	1	Cisco CSR 2019		CBSM	
Cisco	Sustainability Conferences	Employees	4	conferences	4 types of conferences annually on sustainability	1	Cisco CSR 2019	Cisco Green, Cisco Greenhouse, Circular Economy Newsletter, SustainX	CBSM	
Cisco	Annual Shutdown	Energy	3,500	Metric tonnes CO2e	energy use avoided by people going on xmas break and shutting down computers.	1	Cisco CSR 2019	I hate capitalism	CBSM	
Cisco	Recycle IT Day	Waste	422,108	pounds of ewaste	ewaste recycle day (employee personal items and company materials)	1	Cisco CSR 2019		CBSM	
Cisco	Earth Awareness	Employees	n/a	n/a	Earth Month x2	1	Cisco CSR 2019		CBSM	
Cisco	Stretch Assignments	Employees	n/a	n/a	Asking employees to get involved in greening their projects	1	Cisco CSR 2019		CBSM	
Cisco	Bike to work day	Employees	n/a	n/a	Bike to work for employees	1	Cisco CSR 2019		CBSM	

Cisco	Supplier Code of Ethics & Sustainability	Suppliers	n/a	n/a	"Cisco Supplier Guide: Sustainability, Risk and Security"	2	Cisco CSR 2019	https://www.cisco.com/c/dam/en_us/about/supplier/suppliers-guide-e-book.pdf	Business Practice	
Cisco	Supplier Code of Ethics & Sustainability	Suppliers	n/a	n/a	Responsible Minerals Policy	2	Cisco CSR 2019	https://www.cisco.com/c/dam/en_us/about/citizenship/environment/docs/responsible-minerals-policy.pdf	External Partner	
Cisco	Supply Chain Emissions	Emissions	1,152,562	Metric tonnes CO2e	avoiding metirc tones CO2e from supply chain	3	Cisco CSR 2019		Business Practice	
Cisco	Energy Mix	Energy	100%	%	100% of electricity in US is renewable	1	Cisco CSR 2019		Business Practice	
Cisco	Energy & GHG	Energy	19.4	GWh	energy avoided through internal operations efficiency	1	Cisco CSR 2019	Translates to 71,00 metric tonnes CO2e and cost $9.3 million for these 43 projects.	Business Practice	Best practices: Updating lighting controls and LED, solar window film to reduce heat gain, waterside economization and dry cooler tech to improve free cooling, balancing airflow in labs, recomissioning chillers and hvac units, employee engagement abt coservation
Cisco	Environmental Policy Standard	Facilities	90%	%	% of Cisco sites that comply with ISO14001	1	Cisco CSR 2019		Business Practice	
Cisco	Energy Mix	Energy	83%	%	% of global energy that comes from renewables	1	Cisco CSR 2019		Business Practice	
Cisco	Total Emissions Scope 1	Emissions	41,181	Metric tonnes CO2e	Metric tonnes co2e, Scope 1	1	Cisco CSR 2019		Business Practice	
Cisco	Total Emissions Scope 2 (location based)	Emissions	651,331	Metric tonnes CO2e	Metric tonnes co2e, Scope 2	1	Cisco CSR 2019		Business Practice	
Cisco	TotalEmissions Scope 2 (market based)	Emissions	187,428	Metric tonnes CO2e	Metric tonnes co2e, Scope 2	1	Cisco CSR 2019		Business Practice	
Cisco	Emissions 1 & 2 (location-based) per million $ in revenue	Emissions	13.3	Metric tonnes CO2e/$1million	Calculation	2	Cisco CSR 2019		Business Practice	
Cisco	Total GHG emissions: Scope 1&2 (market based)	Emissions	228,610	Metric tonnes CO2e	Scope 1 & 2 market-based GHG emissions	2	Cisco CSR 2019		Business Practice	
Cisco	Energy Generated	Energy	2.2	GWh	Energy generated onsite and used onsite	1	Cisco CSR 2019		Business Practice	
Cisco	Energy Usage	Energy	1,788	GWh	Energy used	1	Cisco CSR 2019		Business Practice	
Cisco	Indirect energy usage	Energy	1,612	GWh	Indirect purchased electricity	1	Cisco CSR 2019		Business Practice	
Cisco	Direct energy usage	Energy	117	GWh	Direct energy consumption = cisco natural gas + propane + diesel for heating and backup generator and gas/fuel for fleet cars	1	Cisco CSR 2019		Business Practice	
Cisco	Electricity usage	Energy	1,612	GWh		1	Cisco CSR 2019		Business Practice	
Cisco	natural gas usage	Energy	93	GWh		1	Cisco CSR 2019		Business Practice	
Cisco	Stationary diesel usage	Energy	20	GWh	mostly used or backup power generation	1	Cisco CSR 2019		Business Practice	
Cisco	Propane usage	Energy	2	GWh		1	Cisco CSR 2019		Business Practice	
Cisco	Transporation Fuels	Energy	61	GWh	fleet vehicles	1	Cisco CSR 2019		Business Practice	
Cisco	GWh of energy consumed per $billion revenue	Energy	34.5	GWh/$1billion	Calculation	1	Cisco CSR 2019		Business Practice	
Cisco	Energy Usage	Energy	60%	%	60% of operational electricity is used in labs/data centers cooling	1	Cisco CSR 2019		Business Practice	
Cisco	Energy Mix	Energy	1,344	GWh	Electricity from renewable sources	1	Cisco CSR 2019		Business Practice	
Cisco	Employee Commuting	Employees	79,735	Metric tonnes CO2e	emissions from employee commuting	3	Cisco CSR 2019		CBSM	
Cisco	Electric Vehicle Charging Stations	Transportation	500	EV Charging ports (not stations? What's the difference? Multiple ports per station?)	EV stations at San Jose HQ	3	Cisco CSR 2019		CBSM	
Cisco	Company Fleet	Transportation	4,772	company vehicles	Total fleet vehicles	1	Cisco CSR 2019		Business Practice	
Cisco	Company Fleet	Transportation	540	electric company vehicles	total electric company vehicles	1	Cisco CSR 2019		Business Practice	
Cisco	Scope 3 GHG Emissions from sold products	Emissions	24,929,174	Metric tonnes CO2e	Scope 3 emissions from products sold	3	Cisco CSR 2019		Business Practice	
Cisco	Total Water Consumed Global	Water	3,299	m^3, thousands		1	Cisco CSR 2019		Business Practice	
Cisco	Total Water Recycled/Reused	Water	22	m^3, thousands		1	Cisco CSR 2019		Business Practice	
Cisco	Waste Diversion	Waste	81%	%	Diversion Rate	1	Cisco CSR 2019		Business Practice	
Cisco	Waste Emissions	Waste	799	Metric tonnes CO2e	Emissions from landfilling waste	1	Cisco CSR 2019		Business Practice	
Cisco	Waste Emissions avoided	Waste	26,359	Metric tonnes CO2e	Emissions avoided by recycling/composting	1	Cisco CSR 2019		Business Practice	
Cisco	Waste Diversion	Waste	21,000	lbs	lbs of food waste recovered for donation	1	Cisco CSR 2019		CBSM	
Cisco	Waste Diversion	Waste	n/a	% of waste	Breakdown of Waste Audit at San Jose HQ	1	Cisco CSR 2019	Recycling = 47%, Landscape waste = 23%, Compost = 11%, Trash = 7%, OCC = 4% etc	CBSM	
Cisco	Total Operational Trash Waste	Waste	10,498	metric tonnes	figure represents 100% of Cisco facilities	1	Cisco CSR 2019		Business Practice	
Cisco	Total Operational Recycling	Waste	84,80	metric tonnes		1	Cisco CSR 2019		Business Practice	
Cisco	Campus Reusable Program	Waste	6	metric tonnes	plastic avoided (reduced)	1	Cisco CSR 2019	avoided by swapping for reusable mugs in the break room.	CBSM	
Cisco	Scope 3 Emissions from purchased goods and services	Emissions	1,154,682	Metric tonnes CO2e	Scope 3 emissions from goods and services purchased	3	Cisco CSR 2019		Business Practice	
Cisco	Scope 3 emissions Capital Goods	Emissions	58,963	Metric tonnes CO2e	Scope 3 emissions Capital Goods	3	Cisco CSR 2019		Business Practice	
Cisco	Fuel and energy related Scope 3	Emissions	39,080	Metric tonnes CO2e	Fuel and energy related Scope 3	3	Cisco CSR 2019		Business Practice	
Cisco	Upstream transportation and distribution	Emissions	36,598	Metric tonnes CO2e	Upstream transportation and distribution	3	Cisco CSR 2019		Business Practice	
Cisco	Business Travel	Emissions	779	Metric tonnes CO2e	business travel (non-commuting	3	Cisco CSR 2019		Business Practice	
Cisco	Downstream transportation and distribution	Emissions	83,396	Metric tonnes CO2e	downstream transportation	3	Cisco CSR 2019		Business Practice	
Cisco	End of life for sold products	Emissions	272	Metric tonnes CO2e	end of life	3	Cisco CSR 2019		Business Practice	
Salesforce	Scope 1 GHG Emissions	Emissions	6,000	Metric tonnes CO2e	GHG Emissions	1	Salesforce CSR FY2019	energy consumed including private jet and company shuttle.	Business Practice	
Salesforce	Scope 2 GHG Emissions (MBM?)	Emissions	135,000	Metric tonnes CO2e	GHG Emissions	2	Salesforce CSR FY2019		Business Practice	

Salesforce	Scope 3 Emissions	Emissions	142,000	Metric tonnes CO2e	GHG Emissions	3	Salesforce CSR FY2019	"Carbon Neutral Cloud"	Business Practice	Also embodied carbon of IT equipment, managed hosting (?), emissions associated with end user device operation, transportation of data center maint workers
Salesforce	Carbon Credits Purchased	Emissions	283000	Metric tonnes CO2e	GHG Emissions credits purchased to offset	1	Salesforce CSR FY2019	"Carbon Neutral Cloud"	Business Practice	
Salesforce	Renewable Electricity	Energy	63%	%	% of electricity that is renewable at all managed facilities and data centers	1	Salesforce CSR FY2019		Business Practice	
Salesforce	Scope 2 GHG Emissions (LBM)	Energy	291,000	Metric tonnes CO2e	GHG Emissions	2	Salesforce CSR FY2019	Scope 2 includes owned facilities electricity, leased facilities all energy, data centers. Also use of proprietary energy intensity per sqft calculations for unknown office data.	Business Practice	
Salesforce	Total Revenue	Finance	$17,098	$million	Total Revenue of $17.1 Billion	1	Salesforce CSR FY2019		Business Practice	
Salesforce	Board Diversity	Governance	36%	% of employees	% of board members who are women or bipoc	1	Salesforce CSR FY2019		Business Practice	
Salesforce	Number of Employees (Global)	Employees	49,000	number of employees	Employees	1	Salesforce CSR FY2019		Business Practice	
Salesforce	Employee Volunteer Hours	Employees	1,100,000	hours	Employee CSR participation	1	Salesforce CSR FY2019		CBSM	
Salesforce	Charitable Giving	Finance	$70,000,000	$	Charitable Giving	1	Salesforce CSR FY2019		CBSM	
Salesforce	Water total used	Water	164,000,000	gallons	total water use	1	Salesforce CSR FY2019		Business Practice	
Salesforce	Water in Drought Areas	Water	27%	%	water withdrawn in regions with extremely high or high baseline water stress	1	Salesforce CSR FY2019		Business Practice	
Salesforce	Office Space Sustainability	Facilities	74%	%	% of office space achieved or pursuing green building certifications	1	Salesforce CSR FY2019		Business Practice	
Salesforce	Platform Performance	Energy	1.39	PUE	Average power usage effectiveness of platform (?)	1	Salesforce CSR FY2019		Business Practice	
Salesforce	Platform Performance	Energy	0.61	CUE	Average carbon usage effectiveness (?)	1	Salesforce CSR FY2019		Business Practice	
Salesforce	Scope 2 GHG emissions (Location Based)	Emissions	297,000	Metric tonnes CO2e	emissions calculated using location-based methodology	2	Salesforce CSR FY2019		Business Practice	
Salesforce	Employee Commuting	Emissions	38,000	Metric tonnes CO2e	Employee commuting (including company shuttle program)	3	Salesforce CSR FY2019		CBSM	
Salesforce	Office Space Sustainability	Emissions	28,000	Metric tonnes CO2e	emissions from offices	1	Salesforce CSR FY2019		Business Practice	
Salesforce	Business Travel	Emissions	146,000	Metric tonnes CO2e	emissions from business travel including company aircraft	1	Salesforce CSR FY2019		Business Practice	
Salesforce	Data Center Energy	Emissions	264,000	Metric tonnes CO2e	emissions from data centers	2	Salesforce CSR FY2019		Business Practice	
Salesforce	Energy Mix	Energy	63%	%	% of energy that's renewable	1	Salesforce CSR FY2019		Business Practice	
Salesforce	Electricity usage	Energy	659,000	MWh	total electricity consumed	1	Salesforce CSR FY2019		Business Practice	
Salesforce	Office Electricity	Energy	10%	%	% of total energy used in offices	1	Salesforce CSR FY2019		Business Practice	
Salesforce	Data Center Energy	Energy	90%	%	% of total energy used in data centers	2	Salesforce CSR FY2019		Business Practice	
Salesforce	Energy Mix	Energy	% in notes	%	% energy mix at Data Centers	2	Salesforce CSR FY2019	clean/renewable 9%, hyrdo 4%, nuclear 24%, nat gas 32%, coal 29%, other fossil fuels 2%	Business Practice	
Salesforce	Electricity at HQ	Energy	25,583,000	kWh	total electricity consumed in SF HQ city	1	Salesforce CSR FY2019		Business Practice	
Salesforce	Office Carbon Intensity	Energy	3	kgCO2e/Sqft	Annual office carbon intensity	1	Salesforce CSR FY2019		Business Practice	
Salesforce	Green Building Certifications	Certifications	n/a	n/a	Green building programs/certifications	1	Salesforce CSR FY2019	Paris Solutions Campaign, ILFI Tech 20, Embodied Carbon in Construction Calculator, mindful MATERIALS Catalyst Circle	Business Practice	
Salesforce	Green Building Signatories	Certifications	n/a	n/a	Green building programs/certifications	1	Salesforce CSR FY2019	World Green Building Council's Net Zero Carbon Buildings Commitment, Center for Environmental Health's Pledge for Safer Furniture Without Flame Retardants	Business Practice	
Salesforce	Carbon Offset Projects	Carbon Offsets	n/a	n/a	Carbon offset projects are selected through the Gold Standard.	1	Salesforce CSR FY2019	https://www.salesforce.com/blog/2017/04/salesforce-net-zero-greenhouse-gas.html	Business Practice	
Salesforce	Environmental Policy Standard	Employees	n/a	n/a	Signatory	1	Salesforce CSR FY2019	https://www.unitedforparisagreement.com/	CBSM	
Salesforce	Salesforce Sustainability Cloud	Product	n/a	n/a	Help customers analyze environmental data	3	Salesforce CSR FY2019	https://www.salesforce.com/products/sustainability-cloud/overview/	Business Practice	
Salesforce	Working Group participation	Certifications	n/a	n/a	participation	1	Salesforce CSR FY2019	accounting for sustainability, advanced energy buyers group, ceres BICEP Network, Renewable Energy Buyers Alliance, Step Up Coalition, We Are Still In, We Mean Business	CBSM	
Salesforce	Sustainable Development Goal: 7 Affordable Clean Energy	SDG	7	n/a	Sustainable Development Goal	1	Salesforce CSR FY2019		Business Practice	
Salesforce	Sustainable Development Goal: 11 Sustainable Cities and Communities	SDG	11	n/a	Sustainable Development Goal	1	Salesforce CSR FY2019		Business Practice	
Salesforce	Sustainable Development Goal: 12 Responsible Consumption and Production	SDG	12	n/a	Sustainable Development Goal	1	Salesforce CSR FY2019		Business Practice	
Salesforce	Sustainable Development Goal: 13 Climate Action	SDG	13	n/a	Sustainable Development Goal	1	Salesforce CSR FY2019		Business Practice	
Salesforce	Sustainable Development Goal: 15: Life on Land	SDG	15	n/a	Sustainable Development Goal	1	Salesforce CSR FY2019		Business Practice	

Salesforce	Global Supplier Code of Conduct	Suppliers	n/a	n/a	Global Supplier Code of Conduct	3	Salesforce CSR FY2019	https://c1.sfdcstatic.com/content/dam/web/en_us/www/documents/legal/supplier/salesforce-supplier-code-of-conduct.pdf	Business Practice	
Salesforce	Reporting Standard CSR	Governance	n/a	n/a	Report Methodology	1	Salesforce CSR FY2019	Global Reporting Initiative Standards (GRI), Sustainability Accounting Standards Board (SASB), the UN Global Compact, the Task Force on Climate-related Financial Disclosures.	Business Practice	could be useful to compare to other businesses
Nvidia	Annual Revenue	Finance	$11,720,000,000	$	Annual Revenue	1	Nvidia 2019 CSR Report		Business Practice	
Nvidia	Number of Employees (Global)	Employees	13,277	# of employees	Number of employees	1	Nvidia 2019 CSR Report		Business Practice	
Nvidia	Offices participating in Charity events	Employees	15	# of offices	Office charity participation	1	Nvidia 2019 CSR Report		CBSM	
Nvidia	Employee Volunter People	Employees	4,343	# of employees	Employee CSR participation	1	Nvidia 2019 CSR Report		CBSM	
Nvidia	Employee Volunteer Hours	Employees	13,077	hours	Employee CSR participation	1	Nvidia 2019 CSR Report	valued at $322,871	CBSM	
Nvidia	Finance	Finance	$3,297,578	$	Total charitable donations	1	Nvidia 2019 CSR Report	includes matching and in-kind goods/services	CBSM	
Nvidia	Water Consumption Global	Water	95,969	cubic meters	global water consumed	1	Nvidia 2019 CSR Report		Business Practice	
Nvidia	Water Discharge, global	Water	224,044	cubic meters	global water discharged	1	Nvidia 2019 CSR Report		Business Practice	
Nvidia	Diversion Rate	Waste	90%	%	landfill diversion rate	1	Nvidia 2019 CSR Report		Business Practice	
Nvidia	Waste Recycled	Waste	1,288	metric tonnes	recycling	1	Nvidia 2019 CSR Report		CBSM	
Nvidia	waste composted	Waste	1,008	metric tonnes	composting	1	Nvidia 2019 CSR Report		CBSM	
Nvidia	Paper Recycling	Waste	29	metric tonnes	paper recycling	1	Nvidia 2019 CSR Report		CBSM	
Nvidia	Battery Recycling	Waste	46	metric tonnes	battery recycling	1	Nvidia 2019 CSR Report		CBSM	
Nvidia	Hazardous waste recycled	Waste	4	metric tonnes	hazardous waste recycling	1	Nvidia 2019 CSR Report		CBSM	
Nvidia	E-Waste Recycling	Waste	128	metric tonnes	e-waste recycling	1	Nvidia 2019 CSR Report		CBSM	
Nvidia	Lamps recycled	Waste	0.2	metric tonnes	lamps recycled	1	Nvidia 2019 CSR Report		CBSM	
Nvidia	C&D Recycled	Waste	14,051	metric tonnes	c&d waste recycled	1	Nvidia 2019 CSR Report		CBSM	
Nvidia	Landfill Waste	Waste	617	metric tonnes	landfill waste	1	Nvidia 2019 CSR Report		CBSM	
Nvidia	wastewater from another organization	Water	47,373	cubic meters	wastewater	3	Nvidia 2019 CSR Report		Business Practice	
Nvidia	Energy Used Global	Energy	197,923	MWh	energy used global	2	Nvidia 2019 CSR Report		Business Practice	
Nvidia	Energy Used Global Non-Reneuable	Energy	13,614	MWh	nonrenewable energy used global	2	Nvidia 2019 CSR Report		Business Practice	
Nvidia	steam heat/cooling nonrenewable	Energy	253	MWh	steam/cool energy nonrenewable global	2	Nvidia 2019 CSR Report		Business Practice	
Nvidia	Total renewable energy purchased or generated for consumption	Energy	89,020	mwh	total renewable energy	2	Nvidia 2019 CSR Report		Business Practice	
Nvidia	Renewable Electricity	Energy	48%	%	% of electricity that is renewable.	2	Nvidia 2019 CSR Report		Business Practice	
Nvidia	Onsite Solar Generation	Energy	772	mwh	solar energy generated onsite	2	Nvidia 2019 CSR Report		Business Practice	
Nvidia	Total Water withdrawn, global	Water	320,013	cubic meters	total water use	1	Nvidia 2019 CSR Report		Business Practice	
Nvidia	Scope 1 Methane Emissions	Emissions	4	metric tonnes	methane emissions	1	Nvidia 2019 CSR Report		Business Practice	
Nvidia	VOC Emissions	Emissions	0.24	metric tonnes	VOC emissions	1	Nvidia 2019 CSR Report		Business Practice	
Nvidia	carbon monoxide emissions	Emissions	0.31	metric tonnes	carbon monoxide	1	Nvidia 2019 CSR Report		Business Practice	
Nvidia	Scope 1 carbon dioxide emissions	Emissions	2,547	metric tonnes	carbon dioxide emissions	1	Nvidia 2019 CSR Report		Business Practice	
Nvidia	Scope 1 nitrous oxide emissions	Emissions	2	metric tonnes	nitrous oxide emissions	1	Nvidia 2019 CSR Report		Business Practice	
Nvidia	Purchased goods and services	Emissions	254,071	Metric tonnes CO2e	emissions from purchased goods and services	3	Nvidia 2019 CSR Report		Business Practice	
Nvidia	capital goods	Emissions	49,964	Metric tonnes CO2e	emissions from capital goods	3	Nvidia 2019 CSR Report		Business Practice	
Nvidia	Fuel and energy related Scope 3	Emissions	24,146	Metric tonnes CO2e	Fuel and energy related Scope 3	3	Nvidia 2019 CSR Report		Business Practice	
Nvidia	Upstream transportation and distribution	Emissions	38,352	Metric tonnes CO2e	Upstream transportation and distribution	3	Nvidia 2019 CSR Report		Business Practice	
Nvidia	Waste generated in operations	Emissions	991	Metric tonnes CO2e	waste generated in operations	3	Nvidia 2019 CSR Report		Business Practice	
Nvidia	Business Travel	Emissions	51,525	Metric tonnes CO2e	business travel (non-commuting	3	Nvidia 2019 CSR Report		Business Practice	
Nvidia	upstream leased assets	Emissions	8,681	Metric tonnes CO2e	leased assets	3	Nvidia 2019 CSR Report		Business Practice	
Nvidia	Stationary natural gas	Emissions	2,379	Metric tonnes CO2e	natural gas	1	Nvidia 2019 CSR Report		Business Practice	
Nvidia	Distillate fuel oil	Emissions	54	Metric tonnes CO2e	fuel oil	1	Nvidia 2019 CSR Report		Business Practice	
Nvidia	Gasoline	Emissions	119	Metric tonnes CO2e	gasoline	1	Nvidia 2019 CSR Report		Business Practice	
Nvidia	Refrigerants	Emissions	118	Metric tonnes CO2e	refrigerants	1	Nvidia 2019 CSR Report		Business Practice	
Nvidia	Purchased and used electricity market based	Emissions	59,035	Metric tonnes CO2e	electricity market based	2	Nvidia 2019 CSR Report		Business Practice	
Nvidia	purchased heating/cooling market based	Emissions	820	Metric tonnes CO2e	heating/cooling market based	2	Nvidia 2019 CSR Report		Business Practice	
Nvidia	Normalized Carbon Intensity (Scope 1 &2)	Emissions	3.6	carbon intensity score	scope 1 & 2 emissions per headcount	1	Nvidia 2019 CSR Report	Calculation	Business Practice	
Nvidia	Scope 2 GHG Emissions Location Based	Emissions	64,940	Metric tonnes CO2e	scope 2 emissions global total, location based	2	Nvidia 2019 CSR Report		Business Practice	
Nvidia	Supplier Code of Ethics & Sustainability	Suppliers	Online survey complete	Compliance standard	Compliance score from RBA environmental survey (carbon, water, waste)	1	Nvidia 2019 CSR Report	This is Nvidia as a supplier	Business Practice	
Nvidia	Supplier Code of Ethics & Sustainability	Suppliers	ISO14001	Compliance standard	General Sustainability Plan	3	Nvidia 2019 CSR Report	Nvidia uses ISO14001 to review supplier environmental plans	Business Practice	
Nvidia	Employee Metrics	Employees	19%	%	% of employees who are women	1	Nvidia 2019 CSR Report		Business Practice	
Nvidia	Energy Management	Facilities	40%	%	% progress towards ISO 50001 requirements	2	Nvidia 2019 CSR Report		Business Practice	
Nvidia	Clean Energy Data Centers	Energy	50%	%	% of data centers evaluated for clean energy.	2	Nvidia 2019 CSR Report		Business Practice	
Nvidia	RBA Supplier Compliance	Suppliers	90%	%	% of suppliers required to comply with RBA	3	Nvidia 2019 CSR Report		Business Practice	
Nvidia	ISO 14001	General	100%	%	ISO 14001 update including life-cycle of electronics	1	Nvidia 2019 CSR Report		Business Practice	
Nvidia	RBA as a Supplier	Suppliers	100	%	Maintain full membership in RBA as a Nvidia is a Supplier to others	1	Nvidia 2019 CSR Report		Business Practice	
Nvidia	Waste Reduced	Waste	21	%	% reduced in plastic packaging of products	1	Nvidia 2019 CSR Report		Business Practice	
Nvidia	EV Parking Spots	Employees	43	ev parking spots	43 electric vehicle parking spots at HQ	3	Nvidia 2019 CSR Report		CBSM	
Nvidia	Carpooling to Work	Employees	338,000	pounds of CO2	pounds of CO2 avoided by carpooling employees	3	Nvidia 2019 CSR Report		CBSM	

Nvidia	LEED Building	Facilities	500,000	square feet	LEED Gold hq building, 500,000 square feet	1	Nvidia 2019 CSR Report		Business Practice	
Nvidia	Waste Diversion	Waste	90	%	% waste diverted from landfill at HQ	1	Nvidia 2019 CSR Report	recycling awareness campaign, changing to reusables in cafetaria, waste audits.	CBSM	
Nvidia	E-Waste Recycling	Waste	n/a	n/a	"we parnter with a global specialist e-waste vendor for recycling"	3	Nvidia 2019 CSR Report	doesn't say who it is	Business Practice	
Nvidia	Employee Incentives	Employees	88000	$	$1,000 per employee rebate for at-home solar	3	Nvidia 2019 CSR Report		CBSM	
Nvidia	GHG Reporting & Auditing	Certifications	A-	score	A- score from Carbon Disclosure Project	1	Nvidia 2019 CSR Report		Business Practice	
Nvidia	Employee Volunteer Hours	Employees	13,000	hours	Employee Volunteer Hours	3	Nvidia 2019 CSR Report		CBSM	
Nvidia	Employee Charitable Giving	Employees	1,300,000	$	employee charitable giving	3	Nvidia 2019 CSR Report		CBSM	
Nvidia	SDG 15: On Land	SDG	15	SDG	SDG: 15 Life On Land	3	Nvidia 2019 CSR Report	Nvidia products are used for ecosystem research in Costa Rica	CBSM	
Nvidia	SDG 15: Life Belowater	SDG	14	SDG	SDG: 14 Life Below Water	3	Nvidia 2019 CSR Report	Nvidia products used for a coral reef 'experience' in SF?	CBSM	
Nvidia	SDG 11: Sustainable Cities & Communities	SDG	11	SDG	SDG: 11 Sustainable Cities and Communities	3	Nvidia 2019 CSR Report	Nvidia products make self driving cars	CBSM	
Nvidia	SDG 11: Sustainable Cities & Communities	SDG	11	SDG	SDG: 11 Sustainable Cities and Communities	3	Nvidia 2019 CSR Report	they built a recycling robot	CBSM	
Nvidia	SDG 9: Industry, Innovation, Infrastructure	SDG	9	SDG	SDG: 9 Industry, Innovation, Infrastructure	3	Nvidia 2019 CSR Report	Nvidia GPU products used to advance science fields	CBSM	
Nvidia	SDG 8: Decent Work and Economic Growth	SDG	8	SDG	SDG 8: Decent Work and Economic Growth	3	Nvidia 2019 CSR Report	Nvidia products make safer mines and tunnel construction	CBSM	
Nvidia	SDG 5: Gender Equality	SDG	5	SDG	SDG: 5 Gender Equality	3	Nvidia 2019 CSR Report	Nvidia tech to aid in gender parity in hiring	CBSM	
Nvidia	SDG 5: Gender Equality	SDG	5	SDG	SDG: 5 Gender Equality	3	Nvidia 2019 CSR Report	Nvidia products used at Grace Hopper women in STEM	CBSM	
Nvidia	SDG 3: Good Health and Wellbeing	SDG	3	SDG	SDG 3: Good Health and Wellbeing	3	Nvidia 2019 CSR Report	Nvidia products used to visualize cell behavior	CBSM	
Nvidia	SDG 3: Good Health and Wellbeing	SDG	3	SDG	SDG 3: Good Health and Wellbeing	3	Nvidia 2019 CSR Report	Nvidia products used to improve radiology	CBSM	
Nvidia	SDG 3: Good Health and Wellbeing	SDG	3	SDG	SDG 3: Good Health and Wellbeing	3	Nvidia 2019 CSR Report	Nvidia products self driving car	CBSM	