

2019 Greenhouse Gas Inventory for ETS

Prepared for:



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Terminology

Term	Definition
Direct GHG Emissions	GHG emission from GHG sources owned or controlled by the organization Note 1 to entry: This document uses the concepts of equity share or control (financial or operational control) to establish organizational boundaries. [ISO 14064-1:2018]
Global Warming Potential (GWP)	An index that integrates the overall climate impacts of different pollutant emissions in terms of carbon dioxide equivalents.
Greenhouse gas (GHG)	A gas that contributes to the greenhouse effect by absorbing infrared radiation.
Greenhouse gas inventory	The total amount of greenhouse gases (GHG) produced to directly and indirectly support human activities, usually expressed in terms of carbon dioxide equivalent (CO ₂ e). This is also known as greenhouse gas (GHG) footprint.
Hotspot	A process which accounts for a significant proportion of the GHG inventory.
Indirect GHG Emissions	GHG emission that is a consequence of an organization's operations and activities, but that arises from GHG sources that are not owned or controlled by the organization. Note 1 to entry: These emissions occur generally in the upstream and/or downstream chain. [ISO 14064-1:2018]
Organizational boundaries	The boundaries that determine the operations owned or controlled by the reporting company, depending on the consolidation approach taken.

Acronyms

CO ₂	Carbon Dioxide
CBECS	Commercial Buildings Energy Consumption Survey
CO ₂ e	Carbon Dioxide Equivalents
GHG	Greenhouse Gas
GWP	Global Warming Potential
kg	Kilogram
kWh	Kilowatt hour
mi	Mile
MT	Metric Ton
PGS	Purchased Goods and Services
T&D	Transmission and Distribution
USEEIO	United States Environmentally Extended Input-Output

Executive Summary

Educational Testing Service (ETS) was founded in 1947 and is the world's largest private nonprofit testing and assessment organization. Headquartered in Princeton, NJ, ETS develops various standardized tests primarily in the US for K-12 and higher education. ETS also administers international tests in more than 180 countries at over 9,000 locations. ETS occupies 26 buildings around the US and employees approximately 3,000 people.

ETS commissioned SCS Global Services (SCS) to expand the company's sustainability reporting as it relates to GHG emissions. The scope included a comprehensive GHG inventory for Global Operations that includes Scopes 1, 2 and relevant scope 3 emissions, which resulted in the establishment of the company's baseline year measurement. The GHG Inventory is prepared following the 'Operational Control' approach, as defined by the GHG Protocol for calendar year 2019 and includes all greenhouse gas emissions which contribute to Global Climate Change.

The scope of the assessment includes scope 1, energy and fuels combusted or emissions occurring on-site of ETS operations; scope 2, energy and fuels used on-site under; and the following scope 3 categories:

- Purchased goods and services: goods purchased and services for 2019 such as office supplies, furniture, IT services, construction services, food and beverage etc.,
- Capital Goods: buildings or equipment for 2019,
- Fuel and Energy Related Activities: Upstream impacts from fuel and electricity production,
- Waste generation: Waste disposal from ETS facilities,
- Business travel: Transportation and accommodation of employees for business-related activities,
- Employee Commuting: Transportation of employees between their homes and their worksites,
- Downstream Transportation and Distribution: Transportation and distribution of sold products in vehicles and facilities not owned or controlled by the reporting company,
- End of Life Treatment of Sold Products: Waste disposal for the ETS product, i.e. testing materials.

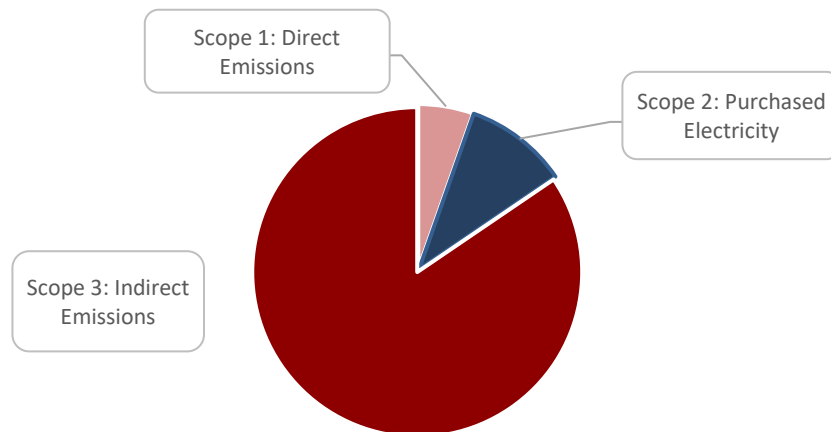
The facilities for which data were gathered were the headquarters located in Princeton, NJ, and additional offices located around the US including 3 warehouses, 2 in New Jersey and 1 in Texas.

The total 2019 carbon footprint by scope category and by pollutant emitted are presented in Table 1 and the contribution by Scope is presented in Figure 1.

Table 1. ETS Carbon Footprint

Category of Source	Subcategory	Total Results in MT CO ₂ e	Breakdown by component pollutant		
			MT CO ₂	MT CH ₄	MT N ₂ O
Scope 1	<i>Mobile Sources</i>	402	185	0.079	0.141
	<i>Stationary sources</i>	3,381	3,378	0.064	0.006
	<i>Refrigeration and Air Conditioning</i>	47	-	-	-
	SCOPE 1 TOTAL	3,831	3,563	0.143	0.148
Scope 2	<i>Purchased Electricity</i>	7,197	7,169	0.442	0.055
	SCOPE 2 TOTAL	7,197	7,169	0.442	0.055
Scope 3	<i>Purchased goods and services</i>	2,073	1,817	9.162	-
	<i>Capital goods</i>	3,384	2,972	14.708	-
	<i>Fuel and energy related activities</i>	2,883	2,868	0.023	0.003
	<i>Business travel</i>	12,576	11,311	45.203	-
	<i>Employee commute</i>	8,586	8,512	1.786	.082
	<i>Waste Generation</i>	341	341	-	-
	<i>Downstream Transportation</i>	30,114	28,112	71.493	-
	<i>End of Life of Sold Products</i>	159	-	-	-
	SCOPE 3 TOTAL	60,117	55,932	142.375	.085
TOTAL (Scope 1 + Scope 2 + Scope 3)	71,145	66,664	142.961	.287	

Figure 1. Contribution to Carbon Footprint by Scope 1, 2 and 3



The largest contributor to the carbon footprint is overwhelmingly Scope 3 categories. Of these, Scope 3: Downstream Transportation, which captures the distribution of testing materials globally, is the single-greatest emitting category at 50% of Scope 3 emissions. Among the activities that fall under downstream transportation, truck transport which represents distribution within the US, contributes more emissions than international distribution. Business travel is the second-most contributing category at 21% of Scope 3 emissions, which stems primarily from air travel and the use of hotels. Employee commute follows closely at 14% of Scope 3 emissions.

1. Introduction

Educational Testing Service (ETS) was founded in 1947 and is the world's largest private nonprofit testing and assessment organization. Headquartered in Princeton, NJ, ETS develops various standardized tests primarily in the US for K-12 and higher education. ETS also administers international tests in more than 180 countries at over 9000 locations. ETS occupies 26 buildings around the US and employees approximately 3000 people.

ETS commissioned SCS Global Services (SCS) to expand the company's sustainability reporting as it relates to GHG emissions. The scope included a comprehensive GHG inventory for Global Operations that includes Scopes 1, 2 and relevant scope 3 emissions, which resulted in the establishment of the company's baseline year measurement. GHG Inventory is prepared following the 'Operational Control' approach, as defined by the GHG Protocol for calendar year 2019.

SCS also provided a customized calculation tool that will enable ETS to calculate its own GHG footprint in subsequent years, enabling the company to move toward a self-sustaining data collection and reporting program.

2. Methodology

2.1 Carbon Footprint Methodology

The Global Climate Change impact category addresses the emissions of greenhouse gases (GHGs) that are responsible for radiative forcing (i.e., warming effects) from interactions in the Earth's atmosphere. All emissions are characterized using Global Warming Potentials (GWPs). GWP values describe the radiative forcing impact of one unit of a given climate pollutant relative to one unit of CO₂. GWP values convert climate pollutant emissions data for non-CO₂ gases into units of CO₂ equivalents (CO₂e) as represented in the equation below:

$$\sum (\text{Pollutant emissions} \times \text{GWP of pollutant}) = \text{Total CO}_2\text{e}$$

Total CO₂ equivalents represent emissions of all GHGs, aggregated and converted to units of CO₂e, using GWP values over a 100-year time horizon. The 100-year GWP values used in evaluating the Global Climate Change impact category are shown in Table 2 below.

Table 2. List of Global Warming Potentials (GWPs) over a 100-year time horizon.

GHGs	GWP (CO ₂ e)	Source
CO ₂	1	IPCC AR5
CH ₄	28	IPCC AR5
N ₂ O	265	IPCC AR5
R-22	1,810	California Air Resources Board ¹ , 2021
R-134A	1,430	US EPA Emission Factors Hub ² , 2021
R-404A	3,922	
R-410A	2,088	

2.2 Data Sources and Emission Factor Datasets

Primary data was obtained from ETS for calendar year 2019:

- Electricity usage (kWh) billed for a majority of facilities by square footage;
- Natural gas usage, billed per facility for a majority of facilities by square footage;
- Fuel usage for all facilities;
- Capital goods and purchased goods and services spend for all facilities;
- Business travel spend on air travel, car rentals, hotels, trains and taxis for all employees;
- Employee commuting survey results by mode of transport and average distance for all facilities;
- Refrigerant purchases for all available facilities;
- Waste management expenses, billed for a majority of facilities by square footage;
- Downstream transportation spend by mode for all facilities and
- End-of-life management for products.

Because some facilities in which ETS operates are leased facilities and many of which ETS occupies a portion of the building, utility, refrigerant and waste data was difficult to obtain for all facilities. A majority of facility data was able to be collected for these data points, with the exception of refrigeration. Extrapolated data is explained in the methodology section, section 2.3.

¹ California Air Resources Board. "High-GWP Refrigerants." <https://ww2.arb.ca.gov/resources/documents/high-gwp-refrigerants#:~:text=What%20is%20Global%20Warming%20Potential%3F&text=The%20most%20common%20refrigerant%20today,a%20ton%20of%20carbon%20dioxide>.

² EPA Center for Corporate Climate Leadership. GHG Emission Factors Hub. <https://www.epa.gov/climateleadership/ghg-emission-factors-hub>

Secondary data was selected from various sources depending on the type of data (spend vs physical unit), the availability of regionality for the category (e.g., landfill tipping fees available by state, whereas recycling fees unavailable), and quality of data, as summarized below.

Table 3. Summary of secondary data sources.

Component	Dataset/ Emission Factor Source	Source	Publication Date
Scope 1			
Stationary sources: Natural gas	CBECS average natural gas usage in the US	US EIA Consumer Building Energy Consumption Survey ³	2012
	GWP for natural gas	EPA Emission Factors Hub, 2021	2021
Stationary sources: Fuel consumption	CBECS average fuel oil usage in the US	US EIA Consumer Building Energy Consumption Survey	2012
	GWP for fuels	EPA Emission Factors Hub, 2021	2021
Refrigeration	GWP for Refrigerants	EPA Emission Factors Hub, 2021 ⁴	2021
Scope 2			
Electricity	US: eGRID by subregion calculated using power profiler tool	US EPA eGRID2019 ⁵	2021
	CBECS average electricity usage in the US	US EIA Consumer Building Energy Consumption Survey	2012
Scope 3			
Purchased goods and services	Category spend per USD, see appendix A	US EPA Environmentally Extended Input Output Model (USEEIO)	2020
Capital goods	Category spend per USD, see appendix B	US EPA Environmentally Extended Input Output Model (USEEIO)	2020
Fuel and Energy related activities	eGRID subregions and grid losses from eGRID2019	US EPA eGRID	2021
	upstream emissions of natural gas and electricity from DEFRA Conversion factors (see ⁶)	DEFRA UK	2019
Business travel	Hotel, train, air travel and vehicle rental and leasing emissions per dollar spent	US EPA Environmentally Extended Input Output Model (USEEIO)	2020
Employee commute	Average emissions from gasoline, hybrid, electric and diesel cars, buses, motorcycles, trucks, trains, subways, bicycles, ferries.	DEFRA UK	2019
	Upstream impacts (WTT) for all fuel uses		
Downstream transport	Truck and air transport emissions per dollar spent	US EPA Environmentally Extended Input Output Model (USEEIO)	2020

³ <https://www.eia.gov/consumption/commercial/data/2012/index.php?view=characteristics>

⁴ https://www.epa.gov/sites/default/files/2021-04/documents/emission-factors_apr2021.pdf

⁵ <https://www.epa.gov/egrid>

⁶ <https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2019>

Component	Dataset/ Emission Factor Source	Source	Publication Date
Waste disposal	Recycling and composting emissions for various material types	DEFRA UK	2019
	Landfill and incineration emissions	EPA Emissions Factor Hub, 2021	2021
End of life treatment of sold products	Landfill and incineration emissions	EPA Emissions Factor Hub, 2021	2021

2.3 Category-specific calculations

Scope 1

Scope 1 stationary emissions consists of natural gas in owned and leased facilities, calculated from natural gas purchases:

$$Emissions = natural\ gas\ use(therms) \times Natural\ gas\ combustions\ emissions\ \left(kg\ \frac{CO_2eq}{therms} \right)$$

Use of natural gas at facilities for which no data was available was estimated using CBECS⁷ and building square footage.

Scope 1 emissions from mobile fuel use occurred in the ETS fleet, operating at a few facilities. Vehicles were able to provide the gallons of gasoline and diesel fuel combusted. Emissions from mobile fuel combusted in leased vehicles were calculated as follows:

$$Emissions = Gasoline\ fuel\ (gals) \times Gas\ combustions\ emissions\ factor\ \left(kg\ \frac{CO_2eq}{gal} \right) \\ +\ diesel\ fuel(gal) \times Diesel\ combustions\ emission\ factor\ \left(kg\ \frac{CO_2eq}{gal} \right)$$

Refrigerant use

Emissions for refrigerants used in facilities were calculated as follows:

$$Emissions = Refrigerant\ charged\ in\ FY\ 2019(lbs) \times GWP100\ of\ refrigerant\ \left(kg\ \frac{CO_2e}{lbs} \right)$$

Refrigerant use was extrapolated by square footage from facilities with primary data to those without data.

Scope 1 emissions for ETS are summarized below:

⁷ Commercial Buildings Energy Consumption Survey. US Energy Information Administration. <https://www.eia.gov/consumption/commercial/>

Emissions Category	Greenhouse gas inventory (metric ton CO ₂ e)	% Contribution to total emissions
Total Scope 1 emissions	3,831	5%

Scope 2

Purchased Electricity

Emission factors for electricity generation in facilities were calculated using the billed electricity use by facility and the emissions factors from eGRID subregions, calculated using the power profiler tool.

$$\text{Emissions for electricity use (kg CO}_2\text{e)} = \sum \text{kWh per facility} * \frac{\text{average kg CO}_2\text{e}}{\text{kWh for eGRID subregion}}$$

Equation 1. Formula used to calculate Scope 2 emissions from electricity use.

Electricity use at facilities for which no data was available was estimated using CBECS in the US and square footage of the facility.

Scope 2 emissions for ETS are summarized below:

Emissions Category	Greenhouse gas inventory (metric ton CO ₂ e)	% Contribution to total emissions
Total Scope 2 emissions	7,197	10%

Scope 3 Categories

Fuel and energy related activities

Fuel and energy related activities consists of upstream impacts of fuel production for owned on-site use (e.g., natural gas for heating) and upstream production of electricity and grid losses from electricity use. Emissions from electricity transmission and distribution losses associated with the electricity grid by state were calculated using percent grid loss data from US EPA.

$$\begin{aligned}
 & \text{Emissions from T\&D losses} \\
 &= \sum \left(kWh \text{ of electricity consumed} \times \text{electricity emission factor} \left(kg \frac{CO_2e}{kWh} \right) \right. \\
 & \quad \left. \times T\&D \text{ loss rate} (\%) \right) \\
 &+ \sum \text{upstream impact of fuels for electricity} \left(\frac{kgCO_2e}{kWh} \right) \times \text{electricity use} (kWh) \\
 &+ \sum \text{upstream impact of natural gas} \left(\frac{kgCO_2e}{gal} \right) \times \text{natural gas} (gal)
 \end{aligned}$$

Equation 2. Formula used to calculate Scope 3 emissions from fuel and energy related activities

Purchased Goods and Services

A spend-based method was used for purchased goods and services (PGS), whereby ETS provided SCS with the total spend by category for January to December 2019, and applying emission factors from the USEEIO database.

$$\begin{aligned}
 & \text{Emissions}(kg CO_2e) \\
 &= \text{spend by (ETS)category} (\$) \times \text{Emission factor for Equivalent USEEIO category} \left(kg \frac{CO_2eq}{\$} \right)
 \end{aligned}$$

Equation 3. Spend-based formula used to calculate PGS

The data provided for purchased goods and services was the full procurement spend for year 2019 by ETS's accounting category for January through December 2019.

Taxes were excluded as they are not relevant to PGS calculations. Utilities (except water) were also excluded as they are covered by other parts of the calculations.

Some categories, each of which represent less than 1% of the total spend, did not have an identifiable equivalent USEEIO category and were not deemed outside of the scope of PGS. These categories were left out of the PGS calculations.

Business Travel

The business travel emissions occur during hotel stays, vehicle leasing, taxi, train and air travel.

A spend-based method was used for business travel, whereby ETS provided SCS with the total spend on hotels, vehicle leasing, taxi, train and air travel, and applying emission factors from the USEEIO database.

$$\begin{aligned} & \text{Emissions for business travel (kg CO}_2\text{e)} = \\ & = \text{spend by business travel category (\$)} \times \text{Emission factor for Equivalent USEEIO category} \left(\text{kg} \frac{\text{CO}_2\text{eq}}{\text{\$}} \right) \end{aligned}$$

Equation 4. Spend-based formula used to calculate Business Travel

Employee Commute

The employee commute emissions are calculated using an employee survey covering ~70% of employees. ETS provided the one-way distance in miles, and type of commute (gasoline vehicle, alternative vehicle, motorcycle, rideshare, subway, train, ferry, bike, bus, walk). Extrapolation was done by total number of employees. It is assumed employees commute 5 days a week in 2019.

$$\begin{aligned} & \text{Emissions for Employee Commute (kg CO}_2\text{e)} \\ & = \sum \text{one way distance (mi)} \times \frac{2 \text{ trips}}{\text{day}} \\ & \times \text{emission factor by commutetype} \left(\frac{\text{kgCO}_2\text{e}}{\text{mi}} \right) \times (\text{number working days per year}) \end{aligned}$$

Equation 5. Mileage-based formula used to calculate Employee Commute

Downstream transportation

A spend-based method was used for downstream transportation, whereby ETS provided SCS with the total spend on air and truck transportation and applying emission factors from the USEEIO database.

$$\begin{aligned} & \text{Emissions (kg CO}_2\text{e)} = \text{spend by downstream transportation category (\$)} \times \\ & \text{Emission factor for Equivalent USEEIO category} \left(\text{kg} \frac{\text{CO}_2\text{eq}}{\text{\$}} \right) \end{aligned}$$

Equation 6. Spend-based formula used to calculate downstream transportation

Waste Generated in Operations

A waste-type-specific method was used for calculating emissions for this category. ETS was able to provide us the mass of waste generated by type in 2019 for major facilities and waste treatment process for some waste categories. Where waste treatment process was not stated, local legislation was used as guidance (i.e., landfill bans) to make assumptions on treatment processes. Emission factors from DEFRA UK and US EPA were then applied.

$$\begin{aligned} & \text{Emissions (kg CO}_2\text{e)} \\ & = \text{weight of waste by type and category (lbs)} \times \text{Emission factor for waste treatment by type} \left(\text{kg} \frac{\text{CO}_2\text{eq}}{\text{lbs}} \right) \end{aligned}$$

Equation 7. Mass-based formula used to calculate Waste generation

Partial data was received for this category, and waste spend for facilities without data were extrapolated on a per capita basis.

End of life of sold products

A spend-based method was used and involved determining the amount of money spent on end-of-life of sold products and applying emission factors from USEEIO for “waste management and remediation” to evaluate this category.

$$\text{Emissions (kg CO}_2\text{e)} = \text{Amount spent on disposal of sold products (\$)} \times \text{Emission factor for end of life treatment scenario} \left(\text{kg} \frac{\text{CO}_2\text{eq}}{\text{\$}} \right)$$

Equation 8. Spend-based formula used to calculate Waste generation

Scope 3 emissions for ETS are summarized below:

Emissions Category	Greenhouse gas inventory (metric ton CO ₂ e)	% Contribution to total emissions
Total Scope 3 emissions	60, 117	85%

3. Greenhouse Gas Inventory Hotspot Analysis

3.1 Summary of Greenhouse Gas Inventory Assessment

Sources of greenhouse gases are classified into Scopes 1, 2, and 3. The inventory for Scope 1 encompasses greenhouse gas emissions from on-site heating and mobile fuel source used in ETS facilities and leakage of refrigerants. Scope 2 emissions are associated with the generation of purchased electricity required for lighting, air-conditioning, computers and use of other appliances. Scope 3 emissions include indirect emissions associated with business travel, downstream transportation, fuel and energy related activities not captured in Scope 1 and 2, purchased goods and services, capital goods, employee commute, waste management, and end of life treatment of sold products.

The baseline greenhouse gas inventory was evaluated for January to December 2019 according to the organizational and operational boundaries specified by The Greenhouse Gas Protocol⁸. The greenhouse gas emissions from ETS operations were calculated and converted to CO₂ equivalents using the Global Warming Potential (GWP100) metric, evaluated over a 100-year time horizon.

⁸ WRI. Greenhouse Gas Protocol. <https://ghgprotocol.org/>

Table 4 summarizes total Scope 1, Scope 2, and Scope 3 emissions for ETS for the 2019 calendar year. Scope 3 emissions are disaggregated into business travel, downstream transportation, fuel and energy related activities not captured in Scope 1 and 2, purchased goods and services, capital goods, employee commute, waste management, and end of life treatment of sold products

Table 4. Baseline greenhouse gas inventory results for 2019 in terms of metric tons CO₂e..

Category of Source	Subcategory	Total Results in MT CO ₂ e	Breakdown by component pollutant		
			MT CO ₂	MT CH ₄	MT N ₂ O
Scope 1	<i>Mobile Sources</i>	402	185	0.079	0.141
	<i>Stationary sources</i>	3,381	3,378	0.064	0.006
	<i>Refrigeration and Air Conditioning</i>	47	-	-	-
	SCOPE 1 TOTAL	3,831	3,563	0.143	0.148
Scope 2	<i>Purchased Electricity</i>	7,197	7,169	0.442	0.055
	SCOPE 2 TOTAL	7,197	7,169	0.442	0.055
Scope 3	<i>Purchased goods and services</i>	2,073	1,817	9.162	-
	<i>Capital goods</i>	3,384	2,972	14.708	-
	<i>Fuel and energy related activities</i>	2,883	2,868	0.023	0.003
	<i>Business travel</i>	12,576	11,311	45.203	-
	<i>Employee commute</i>	8,586	8,512	1.786	.082
	<i>Waste Generation</i>	341	341	-	24.497
	<i>Downstream Transportation</i>	30,114	28,112	71.493	-
	<i>End of Life of Sold Products</i>	159	-	-	-
	SCOPE 3 TOTAL	60,117	55,932	142.375	.085
TOTAL (Scope 1 + Scope 2 + Scope 3)	71,145	66,664	142.961	.287	

3.2 Contribution Analysis

Figure 2 illustrates the percentage contribution associated with Scope 1, Scope 2, and Scope 3 emissions, to the ETS 2019 greenhouse gas inventory. The graph indicates that Scope 1 emissions account for only 5% of the total greenhouse gas inventory. Scope 3 emissions account for ~85% of the total emissions and represent indirect emissions that occur in the value chain of ETS, with half of scope 3 emissions originating from downstream transportation.

The remaining greenhouse gas inventory occurs from Scope 2 emissions (10%). Scope 2 emissions are indirect emissions from the generation of purchased electricity while Scope 1 emissions, in this case, are direct emissions from natural gas use for heating, mobile machinery fuel combustion (fleet), and refrigeration/cooling.

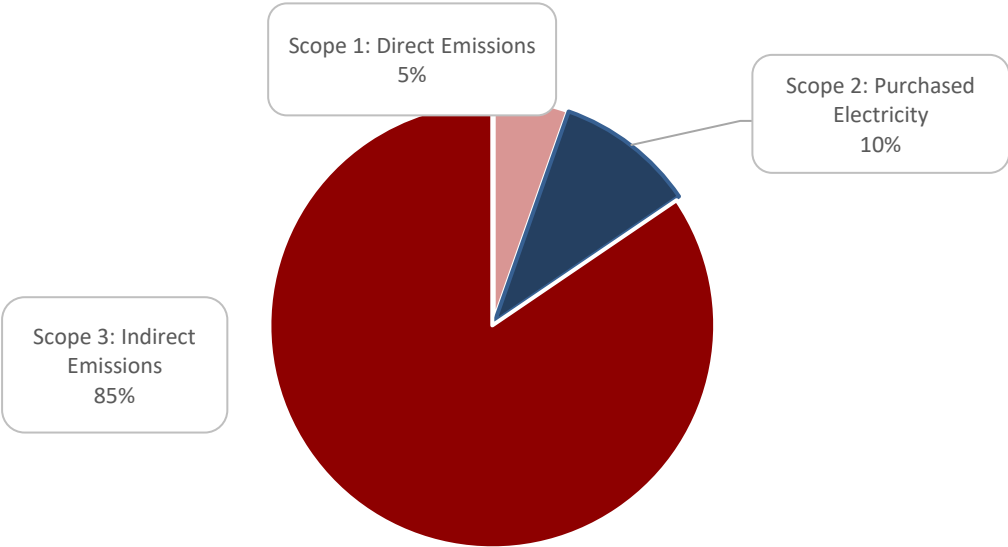


Figure 2. Percent breakdown of total greenhouse gas emissions for ETS in 2019, disaggregated by Scope 1, Scope 2, and Scope 3.

Scope 3 emissions account for the majority of ETS’s 2019 greenhouse gas inventory, primarily downstream transportation (~50% of the total Scope 3 emissions). Figure 3 depicts the percentage contribution of greenhouse gas inventory results for Scope 3 emissions, by category.

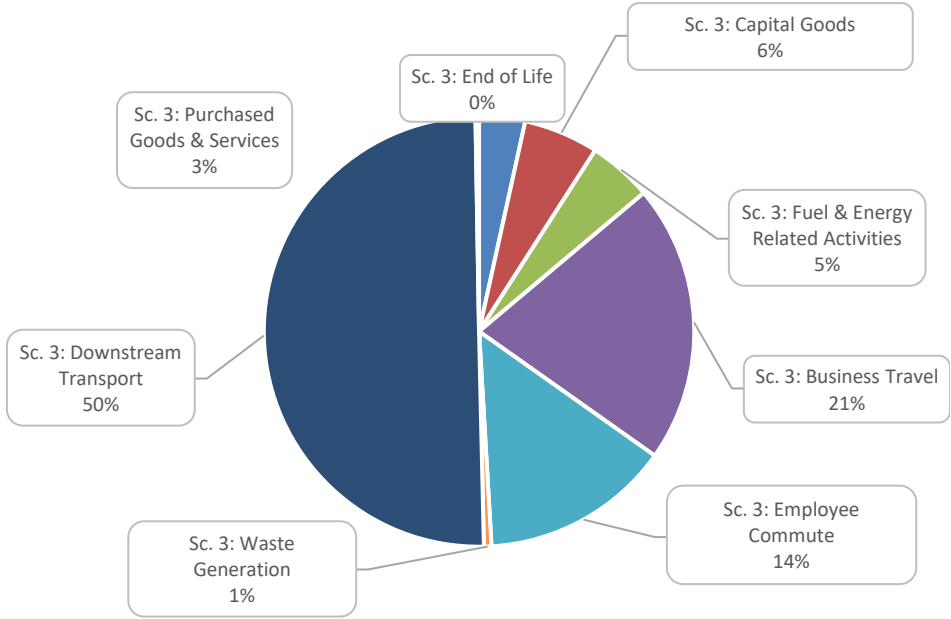


Figure 3. Percent breakdown of total Scope 3 GHG emissions for ETS year 2019.

The category with the largest contributions to Scope 3 emissions is downstream transportation. Within downstream transportation, transport by truck contributes 65% of total downstream transportation, with transport by air contributing the remaining (Figure 4).

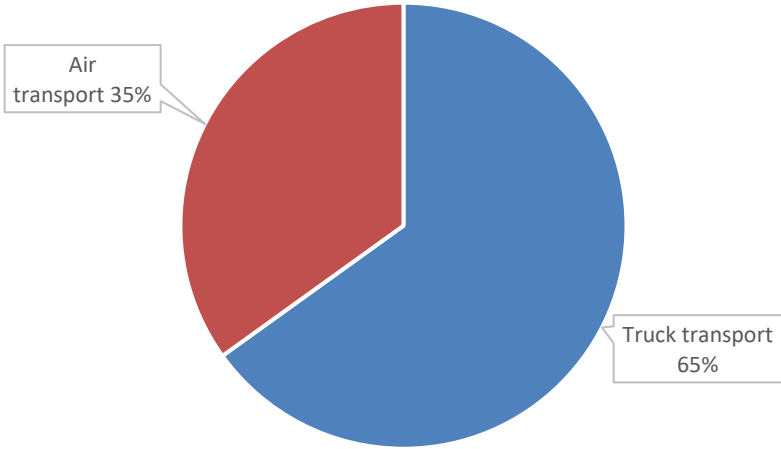


Figure 4. Percent breakdown of downstream transportation for ETS in 2019

Business travel consumes approximately 21% of scope 3 emissions. Of business travel, air travel contributes ~74% of total business travel emissions, and hotel stays contributes another ~24%. The car, train and taxi usage associated with business travel is minimal.

Employee commute accounts for 14% of the total Scope 3 emissions. Of employee commute, most emissions come from employees who use gasoline cars, trucks, rideshare or motorbikes, which also represents the largest group of employees (Figure 5).

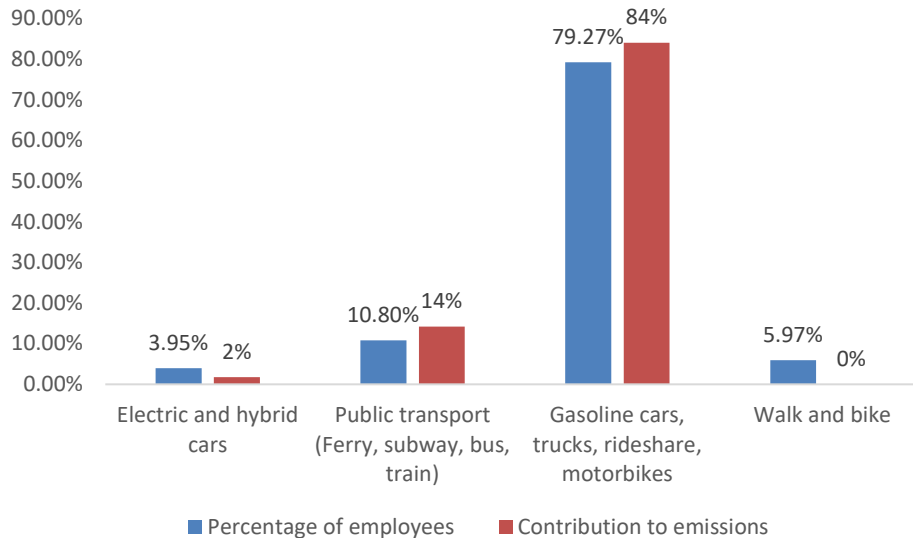


Figure 5. Percent breakdown of employee commute emissions for ETS in 2019, shown side by side with breakdown of commute choice.

Purchased goods and services and capital goods each contribute approximately 3% and 6% of the remaining Scope 3 emissions, while fuel and energy related activities contributes 5%. Waste generation and end of life of sold products all contribute minimally, with 1%, and less than 0.5% respectively.

3.3 Summary of Hotspots for the Key GHG Contributors

Downstream transport makes up 50% of the scope 3 emissions for ETS and 42% of the overall 2019 GHG inventory. To break down further the contribution from of downstream transportation, figure 4 demonstrates that truck transport makes up most downstream transport emissions. The second major contributor to the emissions profile is the category for business travel, which makes up 21% of ETS’s Scope 3 emissions and 18% of the total 2019 inventory. Next, employee commute contributes 14% of the Scope 3 emissions and 12% of total emissions. If the Scope 1, Scope 2 and Scope 3 categories for energy and fuel use are combined (i.e. natural gas, purchased electricity, and fuel and electricity related activities), then this combination accounts for 20% of emissions.

One possible issue for ETS is the uncertainty around refrigerant use. Refrigerant use is difficult to extrapolate from existing data or to find benchmark data for which to extrapolate with certainty given

the wide range of GWPs for different refrigerant types. The major facilities that ETS uses were able to provide data on refrigerant use and this data was extrapolated to those facilities without data by kg CO2e/square foot. From this extrapolation, refrigerant use appears to be a small (less than 0.1%) part of the total footprint for 2019.

4. Benchmarking

To provide further insight into ETS's GHG inventory, ETS provided a list of companies to benchmark their emissions against. Pearson, Church & Dwight and Princeton University published information about their GHG emissions in either 2018 or 2019, although not all categories reported by ETS were reported by the benchmarked company. The available data is shown in Table 5.

Table 5. Summary of GHG emissions for ETS, Pearson, Church & Dwight and Princeton based on selected categories. All figures are shown in MT CO2e.

	ETS (2019)	Pearson** (2019)	Church & Dwight+ (2019)	Princeton (2018)
Total Scope 1	3,831	13,251	87,540	
Total Scope 2	7,197	47,384	78,157	
Total Scope 3	60,117	19,786	213,892	
Sc 3 Business travel	12,576	15,755		
Sc 3 Electricity transmission	2,883	3,462		
Sc 3 Downstream transport	30,114		213,892	
Sc 3 - Others		569		
Total GHG (MT CO2e)	71,145	80,421	379,590	105,000
*Location based emissions are shown for comparison				
+ These are figures from global operations and not US specific.				

Pearson and Dwight both reported a limited number of Scope 3 categories. The breakdown among the reported categories, Scope 1 and 2, are shown in Figure 6. Scope 2 emissions from purchased electricity had the greatest contribution towards emissions for Pearson and ETS, while Scope 1 direct emissions had the greatest contribution towards emissions for Church and Dwight.

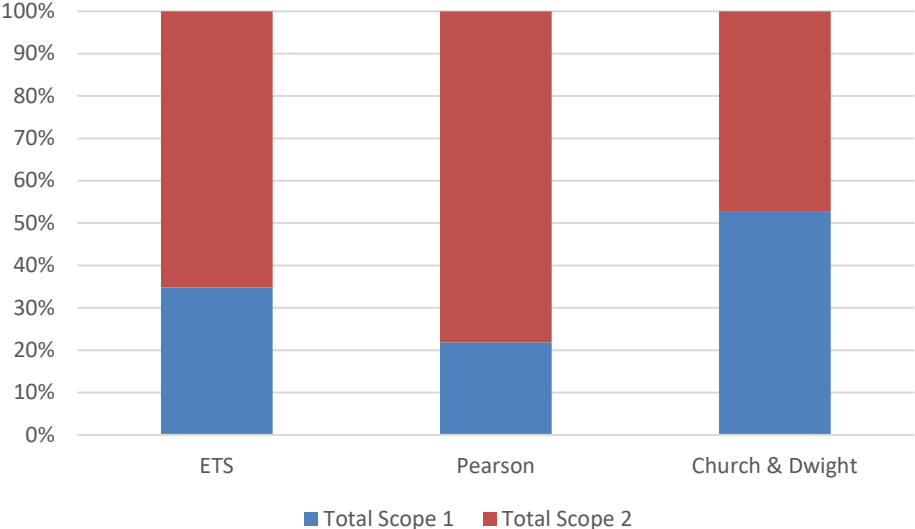


Figure 6. Percent breakdown of emissions for ETS, Pearson and Church & Dwight for Scope 1 and 2.

An intensity-based comparison was also available for Scope 1 and 2 emissions, by total area and number of full-time employees (FTE), which is shown in Table 6. As business operations vary greatly among companies, we caution against using this information for direct comparison.

Table 6. Summary of GHG emissions intensity for ETS, Pearson and Church & Dwight for Scope 1 and 2, to 2 decimal places.

	ETS	Pearson	Church & Dwight
Total GHG per FTE (MT CO2e)	4.2	2.7	34
Total GHG per m² (MT CO2e)	0.04	0.08	-

5. Conclusion

The baseline greenhouse gas inventory was established for ETS in 2019. Results of the GHG inventory are shown in Table 7 and disaggregated by Scope 1, Scope 2, and Scope 3 emissions and are rounded to the nearest whole number.

Table 7. Summary of GHG emissions for ETS in 2019, rounded to whole numbers.

Emissions Category	Greenhouse gas inventory (metric ton CO ₂ e)
Total Scope 1 emissions	3,831
Total Scope 2 emissions	7,197
Total Scope 3 emissions	60,117
Total Scope emissions (Scope 1 + Scope 2 + Scope 3)	71,145

Scope 3 emissions account for ~85% of the total greenhouse gas inventory, with downstream transportation contributing 50% of Scope 3 emissions and 42% of the total inventory.

The remaining greenhouse gas inventory occurs from business travel, at 21% of Scope 3 emissions and 18% of the total GHG inventory, employee commute, 14% of Scope 3 emissions and 12% of the total GHG inventory, and purchased electricity use (10% of the overall footprint). To prioritize the GHG reduction strategies, hotspots were identified. The largest contributors to overall emissions are from downstream truck transport, downstream air transport, business travel by air, and private gasoline cars for employee commute. ETS could potentially see the most benefit in addressing these emission sources by exploring more sustainable downstream transport options for distributing test materials and encouraging less GHG-intensive forms of business travel and commute.

It is recommended to collect more primary, and mass, or physically-based data to improve the precision of future assessments, particularly for downstream transport.

Appendix A: Mapping of ETS PG&S Categories to USEEIO Categories

The following appendix documents the mapping of ETS accounting categories, which were provided under the data request for PGS spend, to the USEEIO expenditure categories. The USEEIO expenditure categories are taken from the Bureau of Economic Analysis (BEA) Business sectors, and the USEEIO database provides data on greenhouse gases emitted per dollar spent on goods and services in this business sector.

ETS categories	USEEIO Categories
GOVERNMENT SERVICES-NOT ELSEWHERE CLASSIFIED	Office administration
Paper storage	Warehousing
Cafe Food	All other foods
BOOK STORES	General merchandise stores
Food Spend	All other foods
BUSINESS SERVICES-NOT ELSEWHERE CLASSIFIED	Marketing research and all other miscellaneous professional, scientific, and technical services
SCHOOLS + EDUCATIONAL SVC-NOT ELSEWHERE CLASSIFIED	Other educational services
INDUSTRIAL SUPPLIES NOT ELSEWHERE CLASSIFIED	Professional and commercial equipment and supplies
NONDURABLE GOODS (NOT ELSEWHERE CLASSIFIED)	General merchandise stores
ORGANIZATIONS MEMBERSHIP-NOT ELSEWHERE CLASSIFIED	Civic, social, professional, and similar organizations
DIRECT MARKETING-COMBINATION CATALOG-RETAIL MERCH.	Directory, mailing list, and other publishers
MISCELLANEOUS AND SPECIALTY RETAIL STORES	All other retail
DIRECT MARKETING-OTHER DIRECT MARKETERS-NOT ELSEW.	Directory, mailing list, and other publishers
ORGANIZATIONS CHARITABLE AND SOCIAL SERVICES	Civic, social, professional, and similar organizations

ELECTRICAL PARTS AND EQUIPMENT	other miscellaneous electrical equipment and components
PLUMBING AND HEATING EQUIPMENT	Metal plumbing drains, faucets, valves, and other fittings
Cafe Paper goods (From DRF)	Paper bags and coated paper
Cafe Beverage (From DRF)	Coffee and tea
CLUBS-CNTRY MBRSHIP(ATHLET REC SPRTS PRIVATE GOLF	Golf courses, marinas, ski resorts, fitness and other rec centers and industries
EATING PLACES RESTAURANTS	Limited-service restaurants
PROFESSIONAL SERVICES-NOT ELSEWHERE CLASSIFIED	Marketing research and all other miscellaneous professional, scientific, and technical services
hotel operating supplies (From DRF)	Professional and commercial equipment and supplies
CATERERS	All other food and drinking places
RECREATION SERVICES (NOT ELSEWHERE CLASSIFIED)	Golf courses, marinas, ski resorts, fitness and other rec centers and industries
TOURIST ATTRACTIONS AND EXHIBITS	Museums, historical sites, zoos, and parks
COMMERCIAL ART GRAPHICS PHOTOGRAPHY	Photography and photocopying equipment
MISCELLANEOUS PUBLISHING AND PRINTING	Books, newspapers, magazines, and other print media
STATIONERY-OFFICE SUPPLIES- PRINTING + WRITING PAP.	Paper
DIRECT MARKETING-CATALOG MERCHANTS	Office supplies (not paper)
COLLEGES UNIV PRO SCHOOLS JUNIOR COLLEGES	Colleges, universities, junior colleges, and professional schools
QUICK COPY REPRODUCTION AND BLUEPRINTING SERVICES	Books, newspapers, magazines, and other print media
CONSULTING MANAGEMENT AND PUBLIC RELATIONS SVCS	Advertising and public relations
CONTRACTORS SPECIAL TRADE-NOT ELSEWHERE CLASSIFIED	Advertising and public relations

CHEMICALS-ALLIED PRODUCTS NOT ELSEWHERE CLASSIFIED	Chemicals (except basic chemicals, agrichemicals, polymers, paints, pharmaceuticals, soaps, cleaning compounds)
COMPUTER SOFTWARE STORES	Software
beverages (From DRF)	Coffee and tea
POSTAL SERVICES-GOVERNMENT ONLY	Postal service
TRAVEL AGENCIES AND TOUR OPERATORS	Travel arrangement and reservation
COMMERCIAL EQUIPMENT NOT ELSEWHERE CLASSIFIED	Air conditioning, refrigeration, and warm air heating equipment
HOME SUPPLY WAREHOUSE STORES	All other retail
ADVERTISING SERVICES	Advertising and public relations
SCHOOLS ELEMENTARY AND SECONDARY	Elementary and secondary schools
ASSOCIATIONS-CIVIC SOCIAL AND FRATERNAL	Civic, social, professional, and similar organizations
COMPUTERS COMPUTER PERIPHERAL EQUIPMENT SOFTWARE	Software
AUTOMOTIVE PARTS ACCESSORIES STORES	Motor vehicle and motor vehicle parts and supplies
LAWN AND GARDEN SUPPLY STORES	Lawn and garden equipment
OFFICE AND COMMERCIAL FURNITURE	Office furniture and custom architectural woodwork and millwork
EMPLOYMENT AGENCIES TEMPORARY HELP SERVICES	Not PSG
TAX PAYMENTS	Not PSG
REAL ESTATE AGENTS AND MANAGERS-RENTALS	Not PSG

Appendix B: Mapping of ETS Capital Goods Categories to USEEIO Categories

ETS categories	USEEIO Categories
LINK PORTION OF THE LAWERNCE/HOPEWELL TRAIL TO CAMPUS ROAD LOOP	Asphalt pavement
Parking Lot Paving at Conference Center	Asphalt pavement
PAVING AT TURNBULL PARKING LOT	Asphalt pavement
26KV &15KV Electrical System Monitoring Upgrade	other miscellaneous electrical equipment and components
QUARTZ COUNTERTOPS AND TILE Z BLDG RESTROOMS	Wood kitchen cabinets and countertops
Install 5KV Switchgear Substation at Mechanical Bldg	other miscellaneous electrical equipment and components
BRIGHAM BLDG RENOVATIONS- LIBRARY REFRESH PROJECT	Commercial structures, including farm structures
INSULATE DUAL TEMPERATURE PIPING IN SOUTH/EAST OFFICE LOOPAND CW MAINS PIPE TO MECHANICAL ROOM LOCATED AT BRIGHAM BLDG	Fabricated pipe and pipe fittings
Z Building Electrical Service Emergency System Upgrade	other miscellaneous electrical equipment and components
Z BATHROOM RENOVATIONS - CLEANING/GROUT RESTORATION	Commercial structures, including farm structures
CAFETERIA KITCHEN LED LIGHTS AT Z BLDG	Light fixtures
SAND SHED REPLACEMENT - FACILITIES	Commercial structures, including farm structures
Z Bldg Upgrade replace (8) BCUs TO SC Building Controllers to complete building automation	other miscellaneous electrical equipment and components
Fire Alarm Replacement L Bldg	other miscellaneous electrical equipment and components

LIGHTING FIXTURE REPLACEMENT FOR SERVERY AREA IN CONANT CAFETERIA	Light fixtures
REPLACE ROOFS AT ANRIG BUILDING	Asphalt shingles
ELECTRICAL WIRING AND EQUIPMENT CONNECTION IN THE SERVERY AREA FOR CONANT CAFE	Communication and energy wire and cable
REPLACE ANRIG HALL SUBSTATION	Commercial structures, including farm structures
NEW ROOF AT V BLDG	Asphalt shingles
INSTALL 2 EA AIR COOLED SCROLL CHILLERS AT CCC	Air conditioning, refrigeration, and warm air heating equipment
HEAT/HOT WATER UPGRADE AT THE LAURIE HOUSE AT CCC	Power boilers and heat exchangers
ADDITIONAL PARKING LOT Q BLDG	Asphalt pavement
EXPAND FIRE ALARM SYSTEM AT V4	other miscellaneous electrical equipment and components
LIGHTING FIXTURES Q CAFE	Light fixtures
ELECTRICAL UPGRADE AND UPS INSTALLATION AT BLDG 10 EXPO PARK	other miscellaneous electrical equipment and components
Replace (5) Lenox Roof top units at Q Building, (Roof top #35,36,37,38,39)	Asphalt shingles
INSTALLATION OF A ONE TON 12000 BTU COOLING UNIT AND ELECTRICAL UPGRADE AT THE SACRAMENTO OFFICE	Air conditioning, refrigeration, and warm air heating equipment
ELECTRICAL WORK IN TECH ROOM: AC AT AUSTIN PROGRAM OFFICE	other miscellaneous electrical equipment and components
COGNEX DATAMAN BARCODE CAMERA/READER SYSTEM FOR THE ETS INTERNAL PRINT SHOP	Other commercial and service industry machinery
AV EQUIPMENT FOR SACRAMENTO, CA OFFICE	Audio and video equipment
4 EA M640 SERVERS 128 GB RAM AND CISCO SMALL BUS SMART PLUS SG220-	Other commercial and service industry machinery

50 SWITCH. LOCATED AT D455B DANIEL ZUCKERMAN	
POWEREDGE R740XD SERVER W (6) 4TB DRIVES PRIMARILY USED BY NLP GROUP SERVER NAME: NIKE	Other commercial and service industry machinery
POWEREDGE R740XD SERVER W (4) 4TB DRIVES PRIMARILY USED BY NLP GROUP SERVER NAME: APOLLO (NON-BLADE)	Other commercial and service industry machinery
POWEREDGE R740 SERVER GPU 16 GB (8) 300GB (2) 2TB (6) USED BY RESEARCH	Other commercial and service industry machinery
POWEREDGE R740 SERVER GPU 16GB (8) 300GB (2) 2TB (6) USED BY PISA/PIAAC PROJECT	Other commercial and service industry machinery
2 EA HASLER DATA PAC DIGITAL MAILING SYSTEM	Other commercial and service industry machinery
24 EA RICOH PRINTERS MODEL SP6430DN USED FOR WAREHOUSE SUPPORT FUNCTIONS.	Other commercial and service industry machinery
2 EA POWEREDGE R740 SERVERS WITH 256GB RAM	Other commercial and service industry machinery
SERVER MOTHERBOARD RAM UPGRADE FOR NLP GROUP	Computer terminals and other computer peripheral equipment
POWEREDGE R740 SERVER WITH 256GB RAM FOR NLP GROUP	Other commercial and service industry machinery
GENETEC HD VIDEO SYSTEM AT SACRAMENTO CA OFFICE 4TH FLOOR CAMARA ADDITION	Audio and video equipment
GENETEC IP HD VIDEO SYSTEM BADGE READER ON 1ST FLOOR IN SACRAMENTO, CA	Audio and video equipment

DELL POWEREDGE 640 SERVER AND RELATED HARDWARE FOR LAB 9738 REBUILD - NGT	Other commercial and service industry machinery
DELL POWEREDGE 640 SERVER AND RELATED HARDWARE FOR LAB 9970 REBUILD - GRE	Other commercial and service industry machinery
AV HARDWARE AT TECH BAR	Audio and video equipment
Directory Server for Security Rack at Z Bldg	Other commercial and service industry machinery
14 ea SF200 ECO Series Digital Signage Player Equipment and Hardware	Audio and video equipment
PROJECTION SYSTEM UPGRADE FOR ROOM Z-270C	Audio and video equipment
WALL DISPLAYS AND CONTROL PROCESSOR FOR CCC	Audio and video equipment
PC/DOTMANAGER and v12.0 RIPMATE UPDATE, WIN 10 FOR PRINT SHOP AT ROOM Z270	Software
PHONE EQUIPMENT, MOUNT KITS FOR CCC	Other commercial and service industry machinery
POWEREDGE SERVER M640 CTO AND DELL DIGITAL KVM SWITCH DMPU4032 FOR R&D SERVER ROOM	Other commercial and service industry machinery
EXPAND HIGH BAY RACKING SHELVING SYSTEM AT ETS LUDLOW OPERATIONS FACILITY WAREHOUSE V1	Shelving and lockers
SPACESAVER FIXED FOUR POST SHELVING SYSTEM AT V3	Shelving and lockers
MODERNFOLD ACOUSTISEAL 932 MANUALLY OPERATED PANEL PARTITION DOOR AND INSTALLATION FOR CCC LAKE ROOM	Wooden windows, door, and flooring

8 EA S6 ELECTRONIC VEHICLE CHARGING STATIONS AT ROSEDALE CAMPUS	other miscellaneous electrical equipment and components
4 EA S6 ELECTRONIC VEHICLE CHARGING STATIONS AT Z BLDG AND 2 EA FOR Q BLDG	other miscellaneous electrical equipment and components
GENERIC 1 EA SELF COOKING CENTER COMBI OVEN STEAMER B6 AT Z BLDG CAFETERIA	Industrial process furnaces and ovens
CAFE EQUIPMENT (SNEEZE GUARDS) AT Z BLDG CAFE	Laminated plastic plates and shapes
FURNITURE FOR Q BLDG ROOM Q224	Office furniture and custom architectural woodwork and millwork
LOBBY FURNITURE FOR Z BUILDING	Office furniture and custom architectural woodwork and millwork
ERSKINE SNOW BLOWER 53 ES1600, SERIAL #1102561	Other commercial and service industry machinery
CANON VARIOPRINT LEASED EQUIPMENT 1 EA DP115 AND DP140 FOR INTERNAL PRINT SHOP Z260	Other commercial and service industry machinery
VP FURNITURE FOR ROOM L281 LILLIAN LOWERY VP & COO STA K12 & TLC	Office furniture and custom architectural woodwork and millwork
VINYL FLOORING 1033.85 SF FOR TURNBULL NEW LIBRARY	Wooden windows, door, and flooring
PATIO FURNITURE FOR TURNBULL COURT YARD PATIO	Office furniture and custom architectural woodwork and millwork
ACOUSTICAL WALL LOUNGE A/B AT CONANT	Office furniture and custom architectural woodwork and millwork
207 EA INDUSTRIAL PACKING TABLES 72X30 LAMINATE TOP FOR AP PROCESSING AT V BLDG	Office furniture and custom architectural woodwork and millwork

VP FURNITURE FOR SARA LESTER - VP HUMAN RESOURCES & LEARNING RM J121	Office furniture and custom architectural woodwork and millwork
CARPET TILES FOR CONANT CAFE, LOUNGE B & C	Carpets and rugs
SHIFT, LUMIFORM ACRYLIC PANELS, HARDWARE FOR MICRO MARKET AT LANDGRAF HALL	Laminated plastic plates and shapes
CONANT SERVERY AREA EQUIP	Other commercial and service industry machinery
LUXURY VINYL TILE FLOORING FOR CONANT CAFETERIA IN SERVING AREA	Wooden windows, door, and flooring
2 EA BATHROOM RENOVATIONS AT PRESIDENT'S HOUSE	Commercial structures, including farm structures
GREENLEE 854DX QUAD HYDRAULIC CONDUIT BENDER	Commercial structures, including farm structures
SHAW CARPET TILE FOR RM N124 CONFERENCE ROOM	Carpets and rugs
VINYL FLOORING AT V2 FRONT SECURITY HALLWAY	Wooden windows, door, and flooring
2019 ELECTRONIC SCISSOR LIFT JLG, MODEL #2632ES, SERIAL #M200036897 AT EXPO 10 AUSTIN, TX OFFICE	Other commercial and service industry machinery
Installation of a solenoid key release unit and associated wiring to DVL Panel /Breaker Auxiliary contacts (5kV IPA Kirk Key) located near the Mechanical Bldg	other miscellaneous electrical equipment and components
LAGUNITAS LOUNGE SEATING FOR J BLDG	Office furniture and custom architectural woodwork and millwork
FURNITURE FOR NEW PRODUCT DEVELOPMENT GROUP ROOM J168 AREA	Office furniture and custom architectural woodwork and millwork

LAGUNITAS LOUNGE FURNITURE FOR CONANT CAFETERIA	Office furniture and custom architectural woodwork and millwork
Install Fiber Optic Sensors to 17 breaker section and 16 cable sections providing Arc-Flash Protection (5kV Fiber Optic Arc-Flash Protection at Rosedale 5K Substation Near Mechanical Bldg)	other miscellaneous electrical equipment and components
FURNITURE FOR LUDLOW RECEPTION AREA	Office furniture and custom architectural woodwork and millwork
ARAMARK PROVIDED EQUIPMENT PRIMARILY THE J BLDG MICRO MARKET AND INCLUDES POS REGISTERS AND MICRO MARKET FIXTURES	Other commercial and service industry machinery
CABINETRYCOUNTERTOPS FOR MICRO MARKET AT J BLDG	Wood kitchen cabinets and countertops
LAGUNITAS LOUNGE FURNITURE FOR CONANT CAFE	Office furniture and custom architectural woodwork and millwork
FURNISH AND INSTALL QUARTZ COUNTER TOPS AT 2 REGISTER AREAS AND MICROWAVE AREA AT CONANT CAFE	Wood kitchen cabinets and countertops
2018 Ford E350 Cutaway box Van. Vin# 1FDWE3F68JDC16645	Pickup trucks, vans, and SUVs
2019 Ford Transit 150 Passenger Wagon Vin# 1FMZK1YMXXKA64922	Pickup trucks, vans, and SUVs
2018 Ford E350 Cutaway box van Vin# 1FDWE3F68JDC38256	Pickup trucks, vans, and SUVs
2019 Ford Transit 250 Cargo Van Vin#1FTYR1YM5KKB14699	Pickup trucks, vans, and SUVs
2019 Ford Transit 250 Cargo Van Vin # 1FTYR1YM7KKB09942	Pickup trucks, vans, and SUVs

2019 FORD F-650 W/18 FOOT MORGAN BOX BODY FOR IDC VIN #1FDNF6AY1KDF08674	Motor vehicle and motor vehicle parts and supplies
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