Portland Public Schools

Operational Greenhouse Gas Inventory

FISCAL YEARS 2018/19 AND 2020/21

Prepared by **Good Company**
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ACKNOWLEDGEMENTS

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DATA COLLECTION SUPPORT:

The project team would like to thank the numerous PPS staff, contractors, and vendors who graciously gave their time and data to complete the inventory.

CONSULTING TEAM:

Good Company, a sustainability consulting firm based in Eugene, OR supported Portland Public Schools' work on this project. Aaron Toneys of Good Company provided training and data gathering assistance to Portland Public Schools staff and facilitated the use of Good Company's Carbon Calculator (G3C), a proprietary GHG inventory tool. He is the primary author of this report. Beth Miller provided data collection support, data analysis and is a supporting author of the report.

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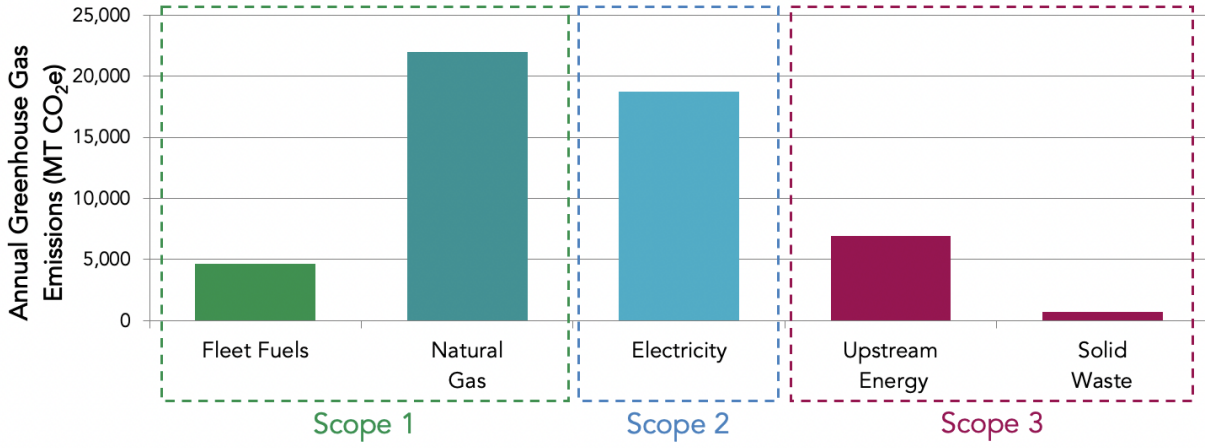
1. EXECUTIVE SUMMARY

In 2022, Portland Public Schools (PPS) passed an ambitious climate action plan, the *Climate Crisis Response, Climate Justice and Sustainable Practices Policy*. A critical first step to implementing the goals in that policy is to conduct a baseline greenhouse gas (GHG) inventory for the district. This report shows the results of that study, using fiscal year 2018/19 (FY19) as the baseline, as instructed by the policy.[1] **Figure 1** presents PPS FY19 GHG emissions.

- Baseline GHG emissions (FY19) as defined in PPS climate policy total 46,055 MT CO_2e. This is the equivalent of emissions from 10,000 passenger vehicles driven for 1 year.
- Natural gas combustion for building systems (space heating, water heating and cooking) is the largest source of impacts (21,981 MT CO_2e) followed by purchased electricity use (18,693 MT CO_2e).
- Fleet fuel emissions are from propane used in buses (3,547 MT CO_2e); and E10 gasoline (933 MT) and B5 diesel fuels (157 MT) used in maintenance vehicles.
- Solid waste is the smallest of PPS's climate impacts, but offers a hands-on, daily opportunity for students to actively participate in climate action by limiting edible food waste, composting, reducing use of and recycling all appropriate materials.
- Climate Action Recommendations: Maximize energy efficiency of buildings and equipment; electrify equipment; continue developing onsite solar and consider participation in renewable electricity programs; pilot and establish a supply of renewable propane for buses in the short term; electrify vehicles as soon as possible.

Figure 1: FY 2018-2019 Emissions by Source and Scope Category



[1] PPS's FY19 GHG inventory includes all sources of emissions defined in PPS's climate policy: combustion of fuels and use of energy in PPS owned or operationally controlled buildings; fuels used by PPS owned or operationally controlled vehicles; and landfill emissions from PPS solid waste disposal.

2. INTRODUCTION

In 2022, PPS established a climate policy which defines its organizational climate, sustainability, and climate justice goals, including specific metrics around greenhouse gas emission reductions:

Portland Public Schools will reduce its greenhouse gas emissions by 50 percent by 2030, using the 2018-2019 school year baseline, and reach net zero emissions by 2040.[2]

As a first step toward reaching those goals, PPS is following best practice climate action planning by completing its first ever baseline greenhouse gas (GHG) inventory for fiscal year 2018/19 (FY19). A GHG inventory measures the emissions associated with a specific operational or geographic boundary, for a specific period of time. By conducting this baseline GHG inventory and future inventories over time it will allow PPS to better understand its emission sources, make data-informed, strategic decisions around emissions reduction initiatives, and track year to year progress towards the goals and targets in PPS's climate policy.

This report summarizes the results of PPS's baseline GHG inventory and offers recommendations for actions that may be used to provide cost-effective GHG reductions.

3. GHG INVENTORY REPORTING CATEGORIES

Greenhouse gas accounting and reporting protocols groups various sources of emissions into categories, which will be referenced throughout this report. To distinguish direct from indirect emissions sources, three "scopes" are defined for GHG accounting and reporting.[3] **Figure 2** illustrates the three emissions scopes which are used to categorize the results of GHG inventories. Emissions are reported in metric tons of carbon dioxide equivalent (MT CO_2e). For details see APPENDIX A: METHODS, and Data Protocols.

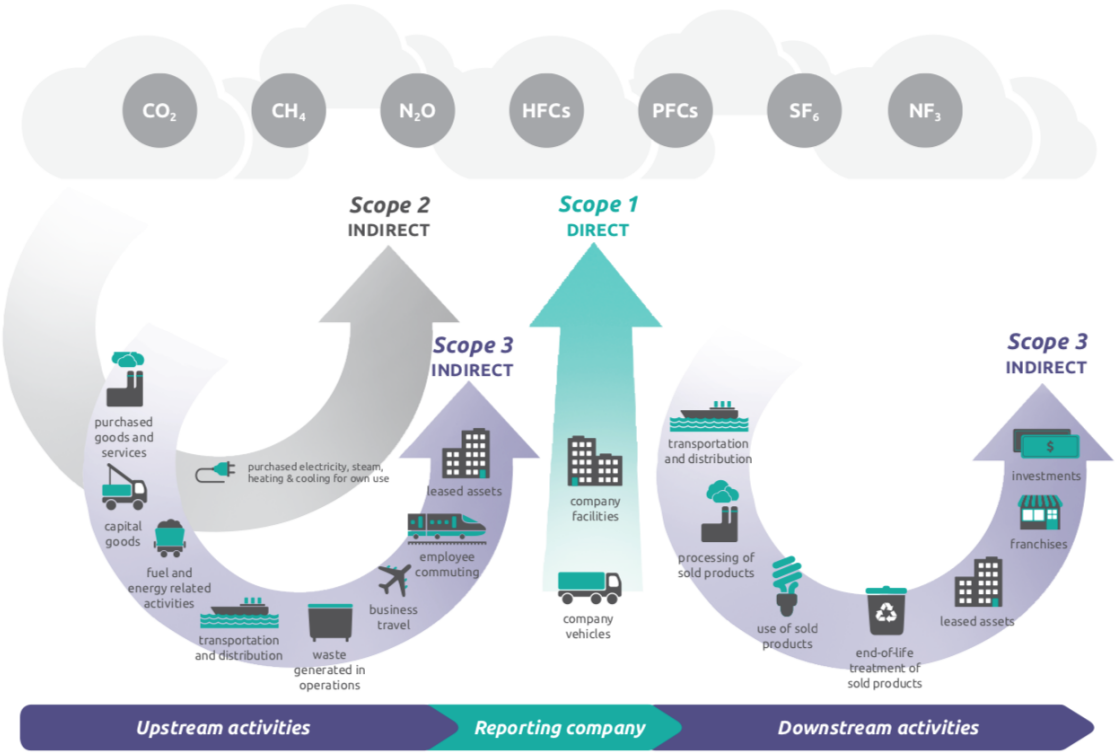
- **Scope 1:** All direct GHGs from equipment and facilities operated by Portland Public Schools. This includes all emissions associated with owned buildings and from all public school associated vehicles. Emissions include those from fossil fuel combustion and process emissions such as loss of refrigerants from cooling and refrigeration systems.
- **Scope 2:** Indirect GHG emissions from electricity purchased for operational needs of owned buildings.

[2] *For the sake of emissions tracking, PPS will use a Scope 1 and Scope 2 analysis, which includes all emissions associated with the following: district- operated buses and fleet vehicles, and building energy use from both natural gas and electricity. In addition to Scope 1 and Scope 2, PPS will also track emissions associated with waste disposal (food waste, recycling, and landfill-bound garbage), which is defined as part of a Scope 3 analysis.

[3] Source: WRI/WBSCD Greenhouse Gas Protocol, Corporate Accounting & Reporting Standard (Revised Edition),

- **Scope 3:** All other indirect emissions sources that result from Portland Public Schools activities but occur from sources owned or controlled by another company or entity in this case, it is limited by PPS policy to emissions from landfill disposal of solid waste.

Figure 2: Greenhouse gases accounting and reporting scopes[4,5]

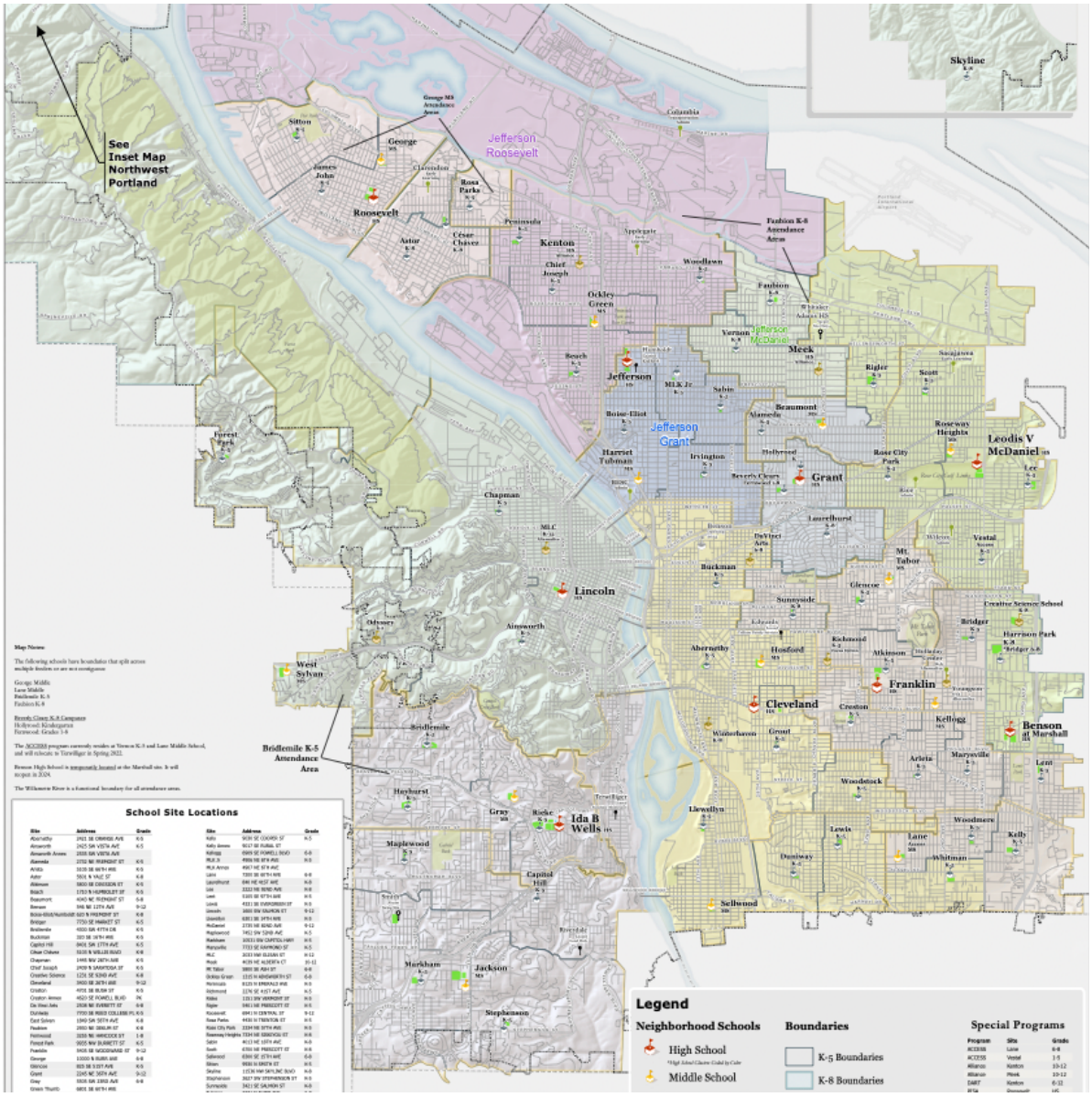


4. PPS GHG INVENTORY BOUNDARIES

PPS provides education and related services to nearly 48,000 students through the work of over 2,800 teachers and staff. During FY19, PPS operated over 100 buildings and a vehicle fleet of over 200 vehicles that provide student transportation and support building maintenance and general operations. **Figure 3** (following page) shows the geographic boundaries used in for the FY19 GHG inventory and the specific locations for school buildings and other facilities.

[4] Source: WRI/WBSCD Greenhouse Gas Protocol, Corporate Value Chain (Scope 3) Accounting Standard
[5] Explanation of Greenhouse Gas chemical formulas: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), nitrogen trifluoride (NF_3), and sulfur hexafluoride (SF_6).

Figure 3: Map of Portland Public Schools geographic territory and facilities



PPS's GHG inventory includes all sources of emissions defined in PPS's climate policy: combustion of fuels and use of energy in PPS owned or operationally controlled buildings; fuels used by PPS owned or operationally controlled vehicles; and landfill emissions from PPS solid waste disposal. **Table 2** (following page) outlines and describes each emissions source in greater detail.

This set of data includes both direct and indirect emissions. ***Direct emissions*** come from sources owned or operationally controlled by a particular organization, such as onsite heating equipment or district owned school buses. Organizations are in direct control of selecting vehicle and equipment types and the related efficiency and fuel types used by the equipment.

Indirect emissions occur because of the organization's actions, but sources of indirect emissions are controlled by a separate business or agency, such as a natural gas facility that creates electricity which is used by a school. Organizations may not be in direct control of these emission sources but can influence indirect emissions through their purchasing power.

Table 2: Description of Portland Public Schools' operational FY19 GHG emissions sources

SCOPE	EMISSIONS SOURCE	EMISSIONS SOURCE DESCRIPTION
Scope 1 (Direct Emissions)	**Fleet (Mobile) Fuels**	Portland Public Schools owns student transport buses, passenger vehicles, and off-road equipment which consume various types of fossil and biofuels including fossil gasoline, E10 gasoline blend (90% fossil gasoline/10% ethanol), B5 diesel blend (95% fossil diesel/5% biodiesel), R20 diesel blend (80% fossil diesel/20% renewable diesel), and fossil propane. PPS's owned fleet includes 200 vehicles and equipment which include vans, pick-up trucks, sedans, SUVs, dump trucks and various offroad equipment. See the Fleet section for additional details.
	Stationary Fuels	Portland Public Schools consumes natural gas for space heating, water heating, and cooking and a small quantity of diesel fuel (B5) in back-up electricity generators at many facilities.
	Refrigerants	Excluded from baseline FY19 inventory due to lack of available data. Refrigerants are used in air conditioning in buildings and vehicles as well as in commercial food refrigeration systems. The PPS bus fleet was confirmed to not have air conditioning systems. *Appropriate data systems are needed to support GHG tracking.*
Scope 2 (Indirect)	**Electricity**	Portland Public Schools consume electricity for many operating functions including lighting, electronics, heating, cooling, ventilation, water heating, and cooking. calculated emissions from electricity consumption from all facilities included in the inventory boundary. Following Greenhouse Gas Protocol's Scope 2 Guidance, emissions from electricity were calculated using both the market-based and location-based methodologies for all seven electric utility providers. *Results in graphics are market-based emissions. See Appendix for location-based details.*
Scope 3 (Indirect)	**Solid Waste**	This category focuses on landfilled solid waste from Portland Public Schools operations as the known largest sources of emission from solid waste management. Specifically, the methane produced from organic materials (like food waste or paper) break down in the landfill. The inventory does not include an account of GHG impacts for other materials being recycled or going to compost. Management of these material do produce small quantities of emissions for transportation and processing, but on net provide a GHG benefit instead of an impact.

Notable Exclusions

- Refrigerant loss in aging air conditioning and other refrigeration systems is common. PPS activity data for this Scope 1 source of emissions was not available for this inventory. Data collection systems should be established to collect data for refrigerant loss by building and vehicles in a future inventory to measure baseline emissions.
- See Section 7, Recommendations for future ghg inventories for additional details.

5. BASELINE FISCAL YEAR 2018/2019 RESULTS

During FY19, Portland Public Schools direct operations and indirect activities generated an estimated **46,055 MT CO_2e** from sources included in PPS's climate policy. **Figure 4** shows the proportional contribution of different sources to that total.

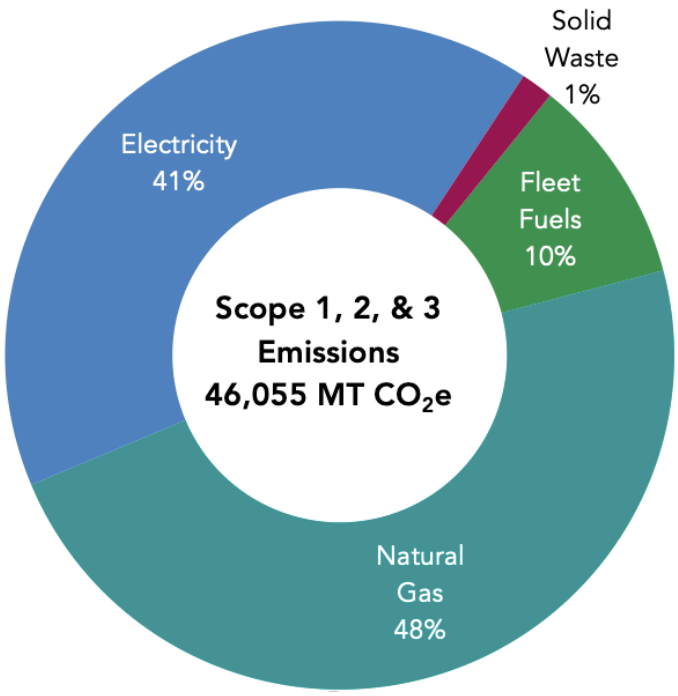
- Building emissions totaled **40,674 MT CO_2e** and make up 89% of total emissions tracked by PPS's Climate policy of which natural gas emissions made up **21,981 MT CO2e** and electricity **18,693 MT CO2e**.
- Transportation was the second largest source of emissions with **4,642 MT CO2e**.
- Solid waste made up a very small proportion of total emissions at **722 MT CO2e**.

Portland Public Schools' FY19 emissions are roughly equivalent to any one of the following:

- Energy use of 7,000 homes in 1 year
- Driving 10,000 cars for 1 year
- Amount of CO_2 sequestered by 66,000 acres of US forest

Calculated with https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

Figure 4: PPS's emissions by category

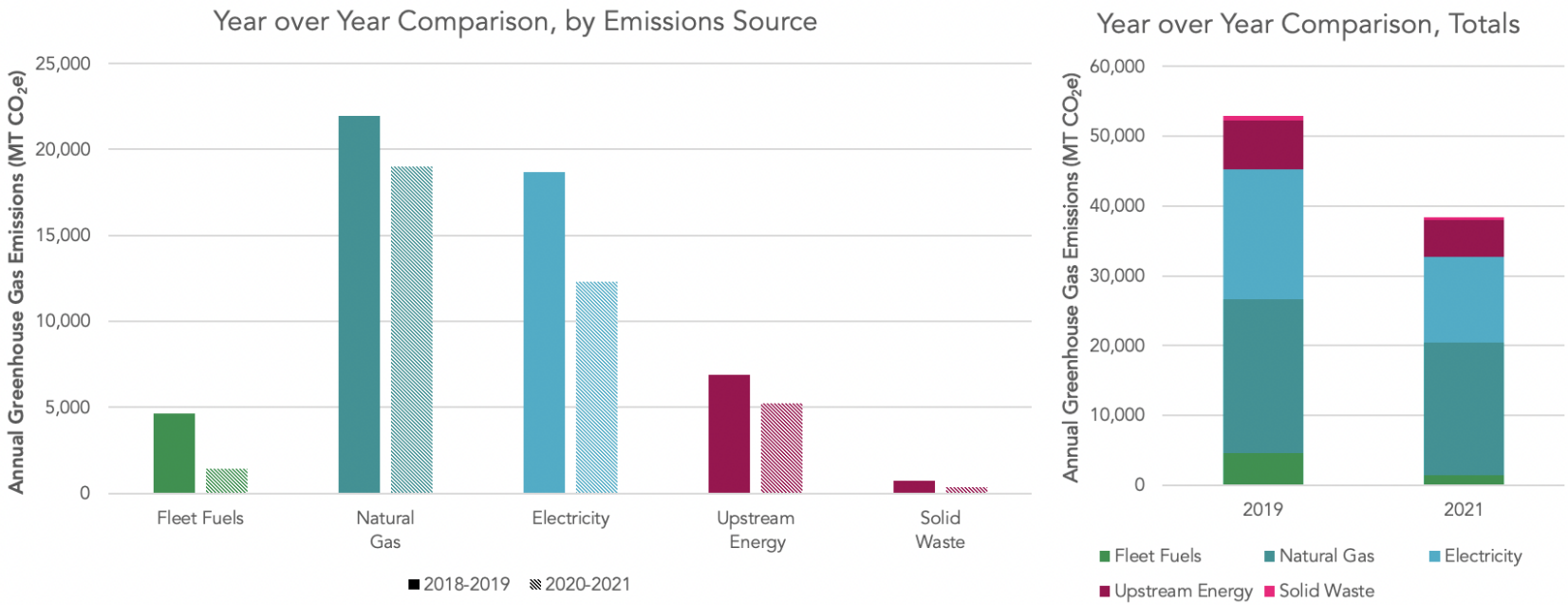


Trends in Emissions - FY19 to FY21

PPS has decided to inventory their emissions every few years to reflect operational changes in a timely manner without creating undue administrative burden. This inventory reports FY2019 and FY2021 to bracket changes and/or disruptions from Covid 19. There was a substantial decrease in emissions, across all sources, between FY19 and FY21, likely the result of operational changes to address the pandemic. The total emissions were 33,159 in FY 2020/21 a decrease of 12,896 MT CO2e or 28%, **Figure 5**

- Natural gas emissions decrease from 21,981 to 19,022 MT CO_2e (13% decrease) Electricity emissions provided the largest decrease, going from 18,693 to 12,313 MT CO_2e (34% decrease).
- Overall electricity emissions decrease by 34%, coming in part from a 27% decrease in use; combined with a 7% decrease in the average carbon intensity of PPS electricity supply (PGE, PacifiCorp, onsite solar).
- Fleet fuels decreased from 4,642 to 1,432 MT CO_2e (69% decrease), mostly from reduced use of buses for student transport during the height of the pandemic.
- Solid waste also decreased from 722 to 359 MT CO_2e (50% decrease)

Figure 5: FY19 vs FY21 emissions



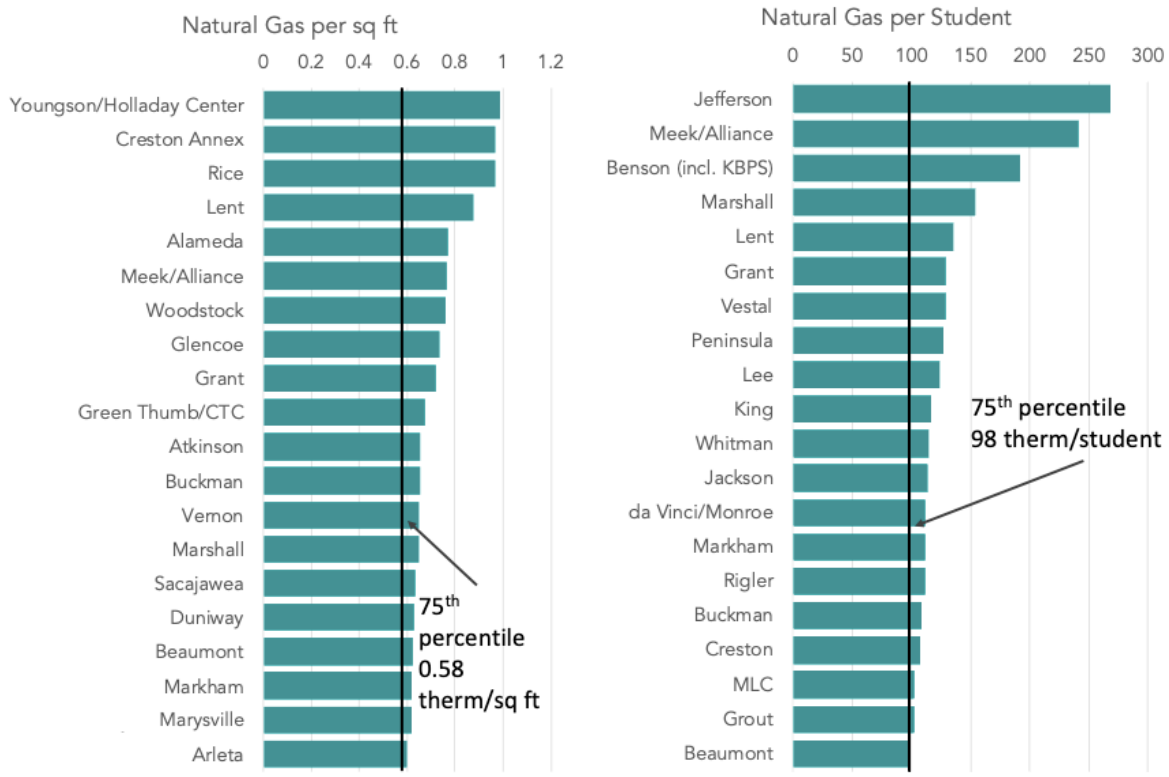
Building Emissions

The largest sources of Portland Public Schools' operational GHG emissions are from natural gas and electricity use in buildings. FY19 baseline emissions are 21,981 MT CO_2e from natural gas and 18,693 MT CO_2e from electricity.

NATURAL GAS

The largest single source of emissions for Portland Public Schools is from natural gas use in buildings. **Figure 6** highlights the top 20 PPS buildings by natural gas usage with two types of GHG intensity metrics including 1) usage (therms) per square footage and 2) usage (therms) per student. These graphics also highlight the facilities that that are in the top 25% by usage intensity to highlight the climate action opportunities. The Youngson Holladay Center[6] had the highest square foot intensity usage, followed Creston and Rice.

Figure 6: Top 20 buildings for natural gas usage by square footage and per student



[6] Note that the lists are not the same, especially since some of the highest emissions buildings (such as Youngson) are not used as schools with defined student populations.

Oregon Climate Policy Highlight - Climate Protection Program

In 2021 Oregon completed rulemaking for the Climate Protection Program (CPP) which will require natural gas utilities (including Northwest Natural) to reduce emissions by 90% by 2050 – through a combination of actions that reduce demand (with more efficient equipment) and increase supply of renewable substitutes that displace fossil gas.

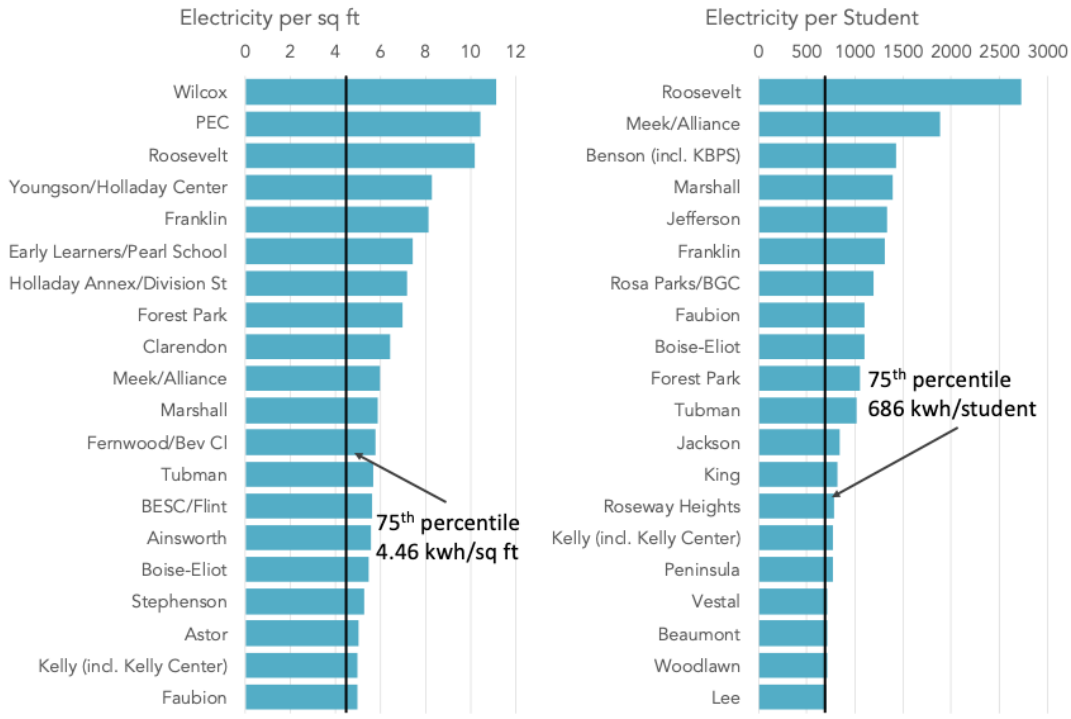
For details visit https://www.oregon.gov/deq/ghgp/Documents/cppInfographic.pdf

ELECTRICITY

PPS's second largest source of GHG emissions is electricity use. **Figure 7** highlights the top 20 PPS buildings by electricity usage with two types of intensity metrics including 1) usage (kWh) per square footage and 2) usage (kWh) per student. These graphics also highlight the facilities that are in the top 25% by usage intensity to highlight the climate action opportunities.

Overall electricity usage across the district is about 4 kWh per square foot, with three buildings, Wilcox, PEC, and Roosevelt using more than 10 kWh per sq foot. Roosevelt HS has relatively high electricity usage due to a significant amount of electric heat as well as cooling. The outlying elementary schools are Rosa Parks, Faubion, Forest Park, and Boise Eliot. Of those, only Faubion and Boise Eliot have relatively high overall emissions compared to other elementary schools.

Figure 7: Top 20 sites for electricity use (in kWh) per square foot and per student



As with all energy and fuel types, the GHG intensity (GHGs / kWh) of the supply matters a great deal to an organization's carbon footprint. This is particularly relevant for electricity because it offers the ability to scale existing, commercially viable technologies (solar, wind) to reduce the carbon intensity of the supply. Other fuels, like natural gas, have renewable substitutes, but those substitutes cannot scale as quickly; they may have limited availability of supply; and they may come at a much higher cost than conventional products. Generating or purchasing renewable electricity also builds a foundation for other climate actions – including the electrification of building systems and vehicles to reduce emissions.

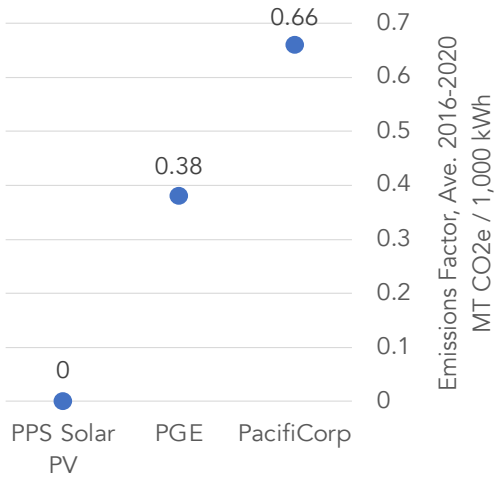
Oregon Climate Policy Highlight – Clean Energy Targets

Oregon recently completed rulemaking on the Clean Energy Targets Bill (HB2021) that requires Portland General Electric, PacifiCorp and Electricity Service Suppliers in Oregon to reduce GHG emissions from electricity generation - 80 percent below baseline emissions levels by 2030; 90 percent below baseline emissions levels by 2035; and100 percent below baseline emissions levels by 2040.

For details visit https://www.oregon.gov/deq/ghgp/Pages/Clean-Energy-Targets.aspx

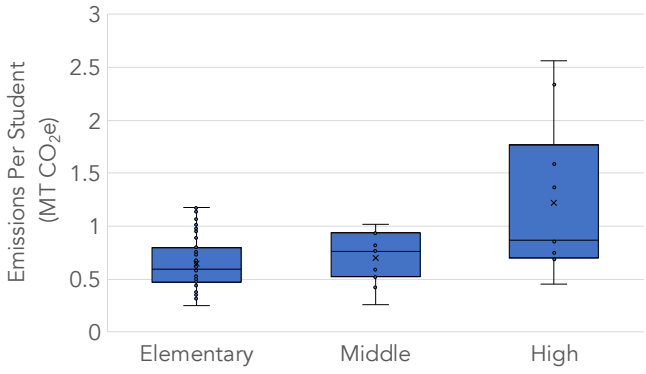
Figure 8 compares average utility-specific emissions factors (2016-2020) with the factor for PPS's onsite solar generation, PacifiCorp's average emissions factor has historically been greater than PGE's. This implies that actions to reduce electricity usage or substitute PacifiCorp's average retail produce with a renewable supply will offer relatively greater climate benefits, and so buildings served by PacifiCorp should be priorities for efficiency and renewable projects.

Figure 8: Comparison of electricity emissions factors that supply Portland Public Schools



COMBINED BUILDING EMISSIONS

Figure 9: FY19 GHGs per student, by school type

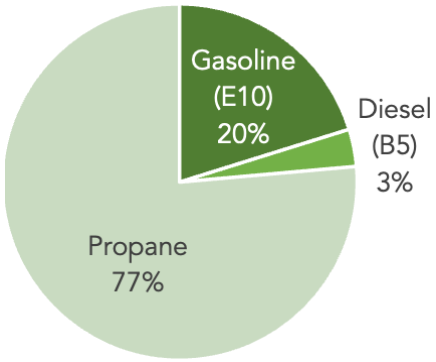


Most buildings emitted between 0.3 and 0.5 MT CO_2e per 100 square feet of building space, with an average emissions intensity of 0.45 MT CO_2e/100sqft (combined GHGs for natural gas and electricity). Among school types, the highest per-student emissions were from high schools (**Figure 9**). The schools with the highest emissions per student in FY19 were Meek/Alliance and Jefferson. The most emissions intensive emitting buildings include PEC, Meek/Alliance, and Wilcox. In general, overall building emissions were correlated with natural gas usage, but Wilcox and PEC were outliers with high emissions despite low natural gas usage. This is likely due to their year-round function as administrative buildings, which brings additional heating, cooling, and lighting needs. They also host IT servers which can be significant power users.

Fleet Fuels

GHG emissions from fuels combusted for student transportation in buses combined with other PPS vehicles used for maintenance, nutrition, etc. make up the largest source after building energy emissions from natural gas and electricity use.

Figure 10: FY19 Transportation emissions sources

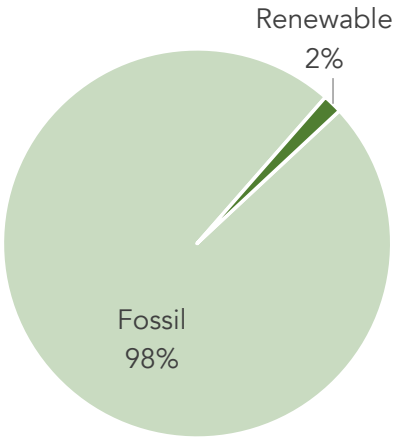


The PPS fleet uses three primary types of fuels in its vehicles: fossil propane, gasoline (E10 blend), and diesel (B5 blend). **Figure 10** shows the relative FY19 GHG emissions contribution for these fuels. GHG emissions from propane represent the greatest share of PPS emissions from fleet fuels.

Figure 11 compares the volume of fossil combusted by PPS to the volume of renewable and biofuels. This ratio is provided as a potentially useful metric moving forward for PPS as renewable and biofuels offer a potential, significant GHG reduction opportunity for fleet fuels along with purchase and use of electric vehicles. Biofuels currently used by PPS include ethanol (as part of the E10 blend) and biodiesel (B5 blend). Use of these blends is mandatory in Oregon. See the Section 5. Recommended GHG Reduction Opportunities.

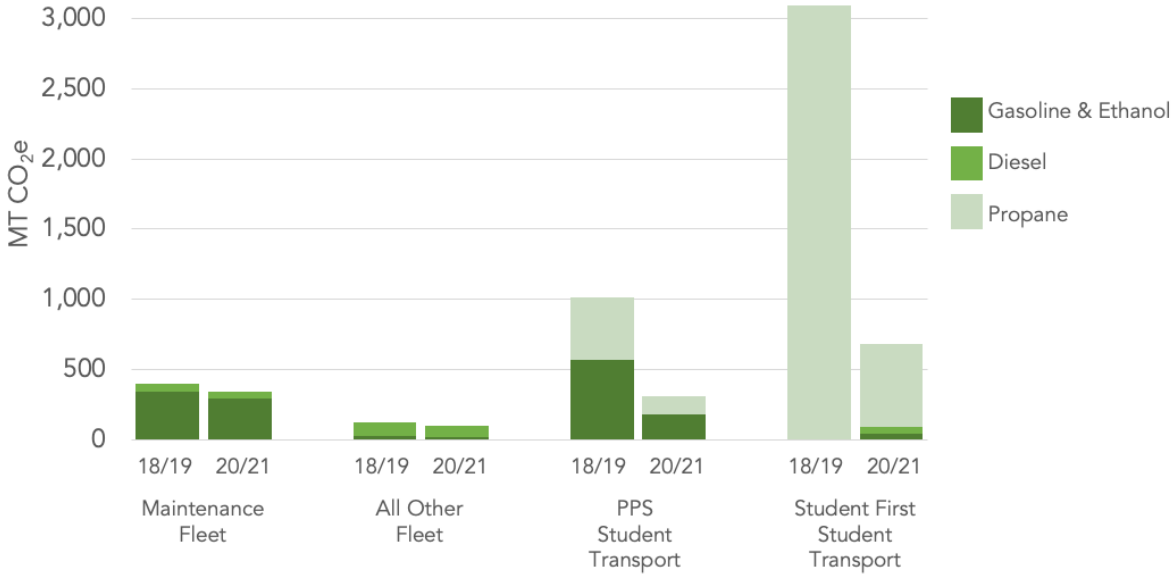
PPS's fleet is composed of four groups: 1) PPS-Student Transportation, 2) First Student Transportation (contracted service by PPS), 3) Maintenance Fleet, and 4) All Other Vehicles. The emissions associated with each group and their fuel use are given in **Figure 12.** The largest share of fleet emissions come from student transportation. The maintenance fleet is the next largest source of emissions, and the rest of the fleet makes up less than 5% of transportation emissions in FY19 and a somewhat larger share (<10%) in FY21.

Figure 11: Proportion of fossil and renewable fleet fuels



There was a substantial decrease in emissions between FY19 and F21. The largest decrease came from the First Student transportation fleet, with another sizeable decrease in the PPS student transportation fleet in both propane and gasoline emissions. There were also small decreases in the non-student transportation emissions. Operational changes due to the pandemic explain this decrease.

Figure 12: Comparison of Transportation Emissions Sources



Oregon Climate Policy Highlight – Clean Fuels Program

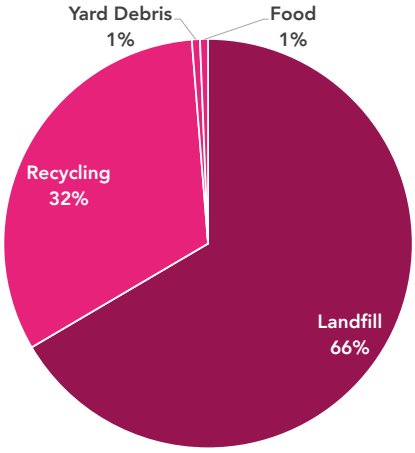
The Clean Fuels Program reduces the GHGs from Oregon's transportation fuels by establishing annual standards that decrease over time. The program supports the transition to renewable biofuels and electricity. CFP requires a 10% reduction in by 2025 (vs 2015): 20% reduction by 2030; and a 37% reduction by 2035.

For details visit https://www.oregon.gov/deq/ghgp/Pages/Clean-Energy-Targets.aspx

Material Management (focus on Landfilled Solid Waste)

Portland Public Schools is developing systems to allow it to consistently and accurately report on its waste production, both in terms of landfilled materials and those that are composted[7] or recycled. For the purpose of this report, PPS used total waste hauls along with assumptions about how full each dumpster was when hauled to approximate results. (See Appendix A for a more detailed description of our methodology.)

Figure 13: Proportion of waste to landfill, recycling, and compost

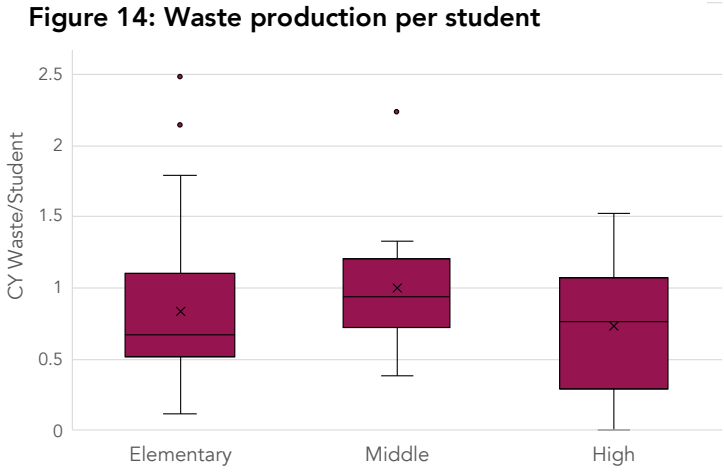


In FY19, PPS recycled nearly 20,000 cubic yards of material and composted nearly 800 cubic yards **Figure 13**.

In terms of climate impacts, GHG inventories focus on those associated with landfill solid waste. In comparison to other sources of emissions, landfilled solid waste is relatively small, just over 1% of total emissions. Waste production per student was relatively consistent across school types (**Figure 14**). Boise Eliot, Rosa Parks, and Lane were the outliers, producing more than 2 cubic yards of landfilled waste per student.

GHG inventory protocols do not give credit for negative emissions associated with composting and recycling, but composting and recycling DO reduce the amount of waste sent to the landfill and therefore the waste emissions as well as displacing the need for new materials. In this case, recycling and composting decreased overall emissions by over 8,000 MT CO_2e, going from a net positive 1,000 MT CO_2e to a net negative 7,000 MT CO_2e.

Figure 14: Waste production per student



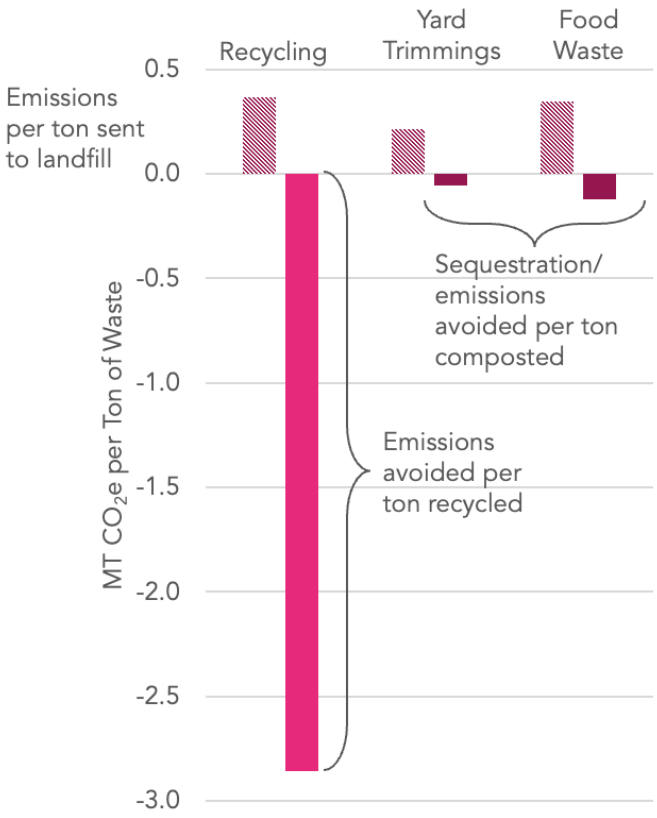
The outsized effect of diverting this material from the waste stream is because much of recycled material and all composted material is organic and will decay in a landfill, releasing methane, a potent greenhouse gas. Diversion of food waste and recycling paper products

[7] Composting is a catch-all term for organic waste diverted from landfill that will be decomposed and ultimately incorporated into the soil. In additional to traditional composting, this could involve spreading of yard waste as mulch or anaerobic digestion which is ultimately spread on fields.

yields an especially large reduction in emissions compared to landfilling: recycling decreases emissions needed to produce new goods and composting leads to avoided landfill emissions; additional storage of carbon in the soil; and replacement of nutrients that may otherwise come from conventional fertilizers.

Figure 15 compares the difference in GHG emissions per ton of materials sent to a landfill to the GHG emissions per ton of the same material being sent to compost or recycling. As can be seen, recycling per ton offers the greatest benefit (for a combination of recycling metals, cardboard, paper, plastics, glass etc.) followed by composted food waste. Food waste offers climate action opportunities both in terms of avoiding edible food waste and diverting food waste from the landfill.

Figure 15: Emissions impact of landfill avoidance



6. RECOMMENDED GHG REDUCTION OPPORTUNITIES

Building Energy Efficiency

Climate action and building decarbonization best practices always begin with and suggest taking full advantage of cost-effective equipment upgrades (particularly at the end of equipment's natural lifespan) to reduce energy consumption and climate impacts.

Natural Gas

Energy efficiency and conservation as it relates to PPS's natural gas use will be a critical climate action for systems that might not be electrified in every school for multiple years, such as natural gas boilers (for space and water heating) in addition to commercial-scale natural gas cooking equipment. See the section below on

electrification for additional details. Energy Trust of Oregon programs financially support upgrades to the following system:

- Space heating upgrades, including electric heat pumps
- Space heating controls (such as programmable and smart thermostats)
- Water heating upgrades, including heat pumps
- Food service, various equipment upgrades (EnergyStar certified appliances)
- Weatherization of building envelopes

Electricity

The following types of energy efficient equipment upgrades were highlighted in the 2021 Northwest Power Plan:

- LED lighting
- Space heating and cooling
- Refrigeration
- Water heating and use, including heat pumps, showerheads, and washers
- Electronics (EnergyStar certified appliances)

Onsite Solar PV

Electricity use is PPS's second largest source of emissions. These emissions come from electric utility-owned or contracted electricity generation that uses fossil fuels. During FY 21, PPS produced about 6% of the total electricity consumed with its owned renewable electricity generation. Continued installation of these systems, where physically and financially appropriate, represent the ideal means to secure a renewable energy supply and provide resilience for critical community infrastructure, particularly if combined with battery storage. As **Figure 8** shows, onsite solar has a GHG intensity of 0 MT CO2e / MWh, resulting in meaningful emissions reductions compared to utility supplied electricity.

Another option to increase PPS's use of solar and other renewable electricity is participation in local electric utility renewable power programs in addition to its onsite solar PV installations. Procurement of renewable electricity is a "super action"; it supports the rapid development of renewable energy generation for the entire grid, a foundational step and necessary precursor to achieving climate goals through mobile and stationary equipment electrification. Furthermore, purchasing renewables supports Oregon utilities as they evolve to comply with Oregon's Clean Energy Targets.[8] which requires GHG emissions-free electricity by 2040.

Renewable Fuels

Substitution of lower-lifecycle climate impact fuels (including renewable natural gas, renewable propane, and renewable diesel) for fossil fuels represents a significant opportunity to reduce the climate impact equipment without negatively affecting operations, existing equipment, or

[8] Details at https://www.oregon.gov/deq/ghgp/Pages/Clean-Energy-Targets.aspx

the quality of services provided. Renewable fuels reduce tailpipe GHG emissions by using plant-based feedstocks to produce the fuel instead of fossil petroleum. The carbon contained in these materials is part of the living carbon cycle and therefore has a much lower climate impact than fuels produced with fossil carbon which has been stored in the earth for millions of years. Details for each of these fuels are below.

Renewable Natural Gas (or verified carbon offsets)

Combustion of fossil natural gas is PPS's largest source of emissions, emitting about 20,000 MT CO_2e per year from building operations. Oregon's Climate Protection Program will support reduction of these emissions by requiring that natural gas utilities reduce emissions by 90% by 2050 through investing in energy efficiency to reduce demand and in parallel developing new sources of low-GHG supply for RNG and clean hydrogen. Oregon's goals will not keep pace with PPS's climate policy and therefore additional work is needed to reduce emissions from fossil natural gas. Oregon's Climate Protection Program requires natural gas reduce emissions by 90% by 2050 which is less aggressive than PPS's policy. To fill the gap PPS may consider a mix of the following: retrofit with electric equipment; increase energy efficiency for gas appliances; procure additional renewable natural gas (RNG) or clean hydrogen from Northwest Natural; and/or purchase carbon offsets (produced locally to regulatory grade compliance standards) as needed to meet PPS climate goals, if the district decides to do so.

Renewable Propane

Combustion of fossil propane is PPS's largest source of vehicle-related emissions, emitting about 3,500 MT CO2e in FY19. Blue Star Gas is one known vendor in the region offering renewable propane for use in transportation. Use of 100% renewable propane (if supported with available supplies) has the potential to almost eliminate PPS's Scope 1 emissions from combustion of propane.

Renewable Diesel

Use of fossil diesel represents a relatively small fraction of PPS's total fleet emissions, but renewable diesel offers a market ready solution from a variety of fuel vendors.

Building Electrification

The major source of emissions for PPS is in their building energy: natural gas and electricity use. In general, because natural gas is a fossil fuel, and electricity in our region is relatively low carbon (and will be ever more so with Oregon's Clean Energy Targets), switching from natural gas to electrical appliances is recommended. Electric heat pumps – for space and water heating – offer the most renewable substitute for fossil natural gas available over the next critical 10 years for climate. However, retrofitting buildings with heat pumps and other electric appliances pose significant financial challenges in buildings that use natural gas for boilers and commercial-scale cooking equipment. Commercially available and cost-effective opportunities

for electric heat pump substitutions are most common as replacements for existing natural gas furnaces, and (depending on circumstances) rooftop heating units.

Vehicle Electrification

Electric vehicles offer the most viable renewable substitute for fossil gasoline available during the next critical 10 years. However, as of this writing, battery electric vehicles can come with significant cost premiums for vehicles and the charging infrastructure. These initial investments pay significant returns from the savings on fuel and reduced need for electric vehicle maintenance compared to internal combustion engine vehicles. To maximize electric vehicle returns, the vehicles need to be used – a lot. Until vehicle purchase costs go down, it is recommended to focus conversions on high-use vehicles (>10,000 miles per year) that have market-ready replacements. The State of Oregon has programs to bring down the initial investment costs for electric vehicles. To accelerate the transition to all electric fleets, organizations that own their own electric charger and would qualify for credits under the clean fuels program can apply to DEQ to be paid in advance for expected credits to offset the initial cost of vehicle purchase.[9] DEQ and PGE have similar programs to incentivize the purchase of electric school busses.[10]

7. RECOMMENDATIONS FOR FUTURE GHG INVENTORIES

- **Establish refrigerant data system.** In future inventories work with school staff and equipment service vendors to track refrigerant loss from cooling system by refrigerant type. This data was unavailable for this inventory but should be included in the future to determine the scale of these emissions. It is expected to be a relatively small impact, but this source is organization dependent and therefore should be accounted for accurately as needed to determine scale. Once the scale is understood an appropriate tracking system may be developed given the scale of the emissions.

Consider additional Scope 3 emission sources: Many additional sources of Scope 3 emissions are common as best practice in GHG inventories including: student commute, employee commute, purchased goods and services (supply chain), etc. These sources might be considered in a future inventory to support related policy and program needs.

[9] https://www.oregon.gov/deq/ghgp/Documents/All-ElectricFleet.pdf

[10] https://www.oregon.gov/deq/ghgp/Documents/ElectricSchoolBuses.pdf

APPENDIX A: METHODS, AND DATA PROTOCOLS

Methods and data used in the inventory are documented in this section of the report; and in corresponding electronic files of Good Company's Operational Carbon Calculator (G3C v5.1) and Inventory Audit Trail. The Audit Trail is a cataloged folder containing all the raw data and related calculation files used in the inventory. The table of contents for the Audit Trail is documented in the Audit Trail worksheet contained in G3C. Combined, these data sources provide detailed documentation for the inventory and provide guidance for conducting future inventories.

PROTOCOLS AND TOOLS

Portland Public Schools' operational GHG inventory follows Greenhouse Gas Protocol's (GHGP) U.S. Public Sector Protocol[11] for Scope 1 and Scope 2 emissions sources, as well as guidance, best practices from a variety of other sources including: GHGP's Scope 2 Guidance and Scope 3 Standard and Calculation Guidance, and EPA's Waste Reduction Model (WARM).

Good Company's Operational Carbon Calculator (G3C v5.1) was used to calculate all GHG emissions for Portland Public Schools' operations. G3C follows the standards set by the Greenhouse Protocol for use of emissions factors and formula's used to calculate emissions.

This inventory includes the "Kyoto gases:" carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulfur hexafluoride (SF_6), perfluorocarbons (PFCs), nitrogen trifluoride (NF_3) and hydrofluorocarbons (HFCs). HFCs, such as refrigerants were not able to be estimated as data was not readily available, but emissions are expected to be relatively small compared to other emissions sources. Portland Public Schools does not use PFCs, NF_3 or SF_6; therefore, those gases are not included. All operational GHG emissions presented in this report are represented in metric tons of carbon dioxide equivalent (MT CO_2e). The GHG calculations use the global warming potentials (GWP) as defined in the International Panel on Climate Change's 5th Assessment Report (IPCC AR5).

METHODS

The following sections briefly describe the data sources and methodology used to calculate emissions. Interested parties should also reference the LGOP protocol which provides method details. The following focuses on noting data sources and details not contained in the protocol.

[11] For details visit: https://ghgprotocol.org/public-sector-protocol-0

OWNED VEHICLES AND EQUIPMENT

Data was collected for propane, diesel, and gasoline blend fuels using a combination using Portland Public School's own reporting from existing data systems. Reports provide activity data in gallons of pure gasoline, E10 gasoline, E85 gasoline, B5 diesel, R20 renewable diesel, and propane fuels. All blended fuel was accounted for as appropriate with proportion of blended material. Scope 1, direct emissions factors are provided by The Climate Registry's 2021 Default Emissions Factors. Lifecycle emissions factors (used to calculate Scope 3, upstream emissions) are provided by Oregon Department of Environmental Quality's (ODEQ) Clean Fuels Program reporting.

NATURAL GAS

Data was collected using invoices, summarized by year within a PPS database, with detailed therm consumption by facility address from sole utility provider Northwest Natural Gas. PPS does not currently participate in NWN's ClimateSmart program or purchase verified carbon offsets from any other vendor. Scope 1, direct emissions factors are provided by The Climate Registry's 2021 Default Emissions Factors. Lifecycle emissions factors (used to calculate Scope 3, upstream emissions) are provided by Oregon Department of Environmental Quality's (ODEQ) Clean Fuels Program reporting.

ELECTRICITY

Data was collected from two electric utilities: Pacific Power/Rocky Mountain Power and PGE. Data was reported using PPS's existing data systems in kWh for all uses. Onsite solar PV data was reported using invoices, summarized by year within a PPS database.

Scope 2 Guidance[12] for electric purchases recommends using two distinct accounting methodologies to calculate electricity-related emissions.

- **Location-based method** (or regional grid) multiplies an organization's electricity use by the average emissions intensity of a specific regional electricity grid that is published by the Environmental Protection Agency (eGRID 2018). Note that over time there may be differences in emissions results for inventory years due to the use of an updated eGRID emissions factor (typically released every two years).
- **Market-based method** (or utility-specific) represents emissions from the electricity procurement contracts that an organization has purposefully chosen. For many, these contracts are with the local electric utility that provides service. Other choices could

[12] For details visit http://www.ghgprotocol.org/scope_2_guidance.

include selection of a specific electricity utility (in markets with more than one); contracting with a specific supplier (in a Power Purchase Agreement); or the purchase of renewable energy certificates. This accounting method multiplies electric purchases by the emissions factors for specific "contractual instruments" that convey the "environmental attributes" from a specific electricity supplier to the purchaser. This method allows organizations to account for the benefit associated with renewable electricity purchases. Utility specific emissions factors for PGE and PacifiCorp are provided by Oregon Department of Environmental Quality in their report, Greenhouse Gas Emissions from Electricity Use[13]

The Scope 2 Guidance recommends using the Market-based Method for goal tracking. Portland Public School's electricity emissions with the location based, regional grid accounting are **11,435 MT CO2e**, compared with roughly **18,693 MT CO2e**, for the market based accounting as noted above. This discrepancy is because the regional grid includes a substantial amount of low-carbon hydroelectric power from the Bonneville Power Authority, most of which is earmarked for use by consumer-owned utilities and not available to the private companies, PGE and Pacific Power. As with vehicle fuels, lifecycle emissions (Scope 3, upstream energy) are calculated using an Oregon average from ODEQ's Clean Fuels Program.

LANDFILLED SOLID WASTE

Operational waste was calculated using invoiced activity data from Republic services. This included yard waste, food waste, recycling, and landfilled solid waste. Data was received in volumes (cubic yards) which are converted to weight using densities provided by the EPA. Emissions factors are provided by EPA's waste reduction model for landfilled mixed solid waste.

Protocol only reports emissions associated with landfilled waste and does not give credit for or take into account alternative waste treatments (such as recycling or composting). This report uses the WARM model to understand the benefits of recycling for PPS (what if all recycling and composted waste had been sent to the landfill) and thereby give a sense of scale for the emissions reductions achieved through PPS's waste reduction efforts.

WARM gives sequestration credit for organic materials in a landfill, however Good Company takes the position that such crediting encourages landfilling over other, higher re-uses of material (such as composting) and does not adequately acknowledge the co-benefits

[13] For details visit https://www.oregon.gov/deq/ghgp/Pages/GHG-Emissions.aspx

associated with diverting waste from the landfill (such as improved soil health). Therefore, we exclude this sequestration credit from the alternative waste treatment comparison calculations.

UPSTREAM ENERGY PRODUCTION

Upstream emissions are calculated using Scope 1 and Scope 2 activity data and lifecycle emissions factors calculated to support ODEQ's Clean Fuels Program. Emissions presented here are the difference between Scope 1 emissions and total life-cycle emissions.