2021

GREENHOUSE GAS EMISSIONS REPORT

Seattle Public Utilities

RELEASED: DECEMBER 2023

Annual report that tracks Seattle Public Utilities' greenhouse gas emissions from service delivery and operations.

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1. Executive Summary

Seattle Public Utilities (SPU) produces annual greenhouse gas inventories detailing emissions generated by our service delivery and operations. We are committed to our One Water, Zero Waste, Community-Centered vision for Seattle; this includes tracking and sharing our progress towards carbon neutrality by 2030.

In 2021, our service delivery and operations generated emissions through the combustion of fossil fuels and through the escape of warming gases from air conditioning and historic landfills, as well as emissions generated to produce electricity that SPU purchased for its operations.

SPU's greenhouse gas emissions in 2021 are slightly higher than in 2020, but less than the 2019 baseline. This minor increase is attributed both to SPU's increase in fuel consumption, as well as small increases in the emissions related to PSE's electricity supply. SPU will continue to pursue climate mitigation solutions that will reduce the emissions we generate and empower us to pursue carbon neutral operations by 2030.

About our 2021 Emissions

Emissions Type	% of SPU emissions
Purchased electricity *for infrastructure and workforce facilities*	46.2%
Vehicle fleet fuel	34.2%
Landfill gas from 3 historic landfills *that no longer accept solid waste*	11.2%
Facility fossil gas combustion *that heats infrastructure and workforce facilities*	4.9%
Fugitive emissions *from HVAC systems*	3.5%
Total	100%

In 2021, we found that:

- Purchased electricity is our largest source of emissions. Most of these emissions are generated by infrastructure and workforce facilities in Puget Sound Energy's (PSE) service area. They are a result of PSE's sources of electricity generation. In 2021, we purchased 54% of our electricity from Seattle City Light (SCL), and 46% from PSE. However, 97.5% of all purchased electricity emissions were derived from PSE sources, while just 2.5% of emissions can be traced to SCL electricity.
- Our vehicle fleet represents 36.7% of our total emissions. Of the fleet's emissions, 34.4% is associated with the combustion of fossil fuels, while 2.3% is associated with fugitive emissions from motor vehicle air conditioning (MVAC) systems.

Key Trends: 2019-2021

Fuel

SPU's fuel consumption largely rebounded to 2019 levels of consumption, as operations returned to standard practices post-pandemic. However, this fuel consumption was not consistent throughout the entirety of the year. Fuel

consumption peaked in March at its highest levels across all inventory years but there was a noticeable decline by the end of the year. November and December 2021 emissions quantities are the lowest among all three inventory years, outside of the pandemic-influenced April and May of 2020. Future analysis will track if these emissions amounts are consistent into 2022, which could indicate that green fleet initiatives are effectively reducing greenhouse gas emissions.

Table 1: Fleet Fuel and Fugitive Emissions

Emissions Source	2019 Emissions (ktCO2e[1])	2020 Emissions (ktCO2e)	2021 Emissions (ktCO2e)
Fleet Fuels	5.0	4.5	4.9
Fleet Fugitive Emissions	0.4	0.3	0.3

Electricity

While total electricity consumption declined in 2021 relative to 2019, total emissions reductions are negligible. The reduction in our electricity consumption was primarily among facilities reliant on SCL power; among PSE-supplied facilities, total energy consumption stayed relatively consistent. Because the emissions intensity of PSE increased slightly in 2021, total emissions from purchased electricity also modestly increased. We anticipate that the emissions associated with long-term purchased electricity will decline as PSE has stated that they intend to be 'net zero' by 2030 and coal-free by 2025[2].

Table 2: Electricity and Fossil Gas Emissions

Emissions Source	2019 Emissions (ktCO2e)	2020 Emissions (ktCO2e)	2021 Emissions (ktCO2e)
Electricity	8.5	6.2	6.6
Fossil Gas	0.6	0.8	0.7

Landfills and Facility Fugitive Emissions

Increases in fuel and electricity emissions were somewhat offset by a decline in fugitive emissions from SPU's historic landfills. This decline in emissions is anticipated in the long term through the natural decomposition of organic matter disposed of within these landfills. However, while the long-term emissions trend is decreasing, we anticipate that individual years could see fluctuations in emissions due to the unpredictable nature of this decomposition.

Facility fugitive emissions, however, remained very constant. As SPU did not replace or repair any facility air conditioning system during 2021, this value remains consistent with 2019 and 2020.

Table 3: Facility Fugitive Emissions

Emissions Source	2019 Emissions (ktCO2e)	2020 Emissions (ktCO2e)	2021 Emissions (ktCO2e)

[1] In this report, "ktCO2e" is defined as the equivalent of 1000 metric tons of carbon dioxide emissions.
[2]https://www.pse.com/en/pages/together#:~:text=By%202045%2C%20PSE%20will%20have,30%25%20emissions%20reduction%20by%202030.

Historic Landfills	*1.8*	*2.0*	*1.6*
Building AC	*0.2*	*0.2*	*0.2*

2. Introduction

Continuing the emissions-tracking efforts that SPU began with the 2019-2020 GHG Inventory Report, this report provides an update on the utility's progress towards carbon neutrality by 2030. As part of our One Water, Zero Waste, and Community Centered vision, SPU is taking urgent steps to reduce our contribution to climate change, as well as to prepare to adapt to ongoing and future impacts as the result of a changing climate.

As established by the previous inventory report, this inventory analyzes SPU's emissions related to the utility's day-to-day operations and direct service delivery. This includes all Scope 1 emissions generated directly by SPU's combustion of fossil fuels, as well as all Scope 2 emissions created to generate the electricity that SPU purchases. This report does not include Scope 3 emissions related to SPU's supply chain or extended emissions. Further analysis on SPU's Scope 3 emissions was conducted in collaboration with Seattle Parks and Recreation and Seattle City Light on a Purchasing & Contracting inventory.

3. Overall Emissions Inventory Results

In 2021, SPU generated operational greenhouse gas emissions equivalent to 14.3 thousand metric tons of CO2 (ktCO2e). Of this total, 6.6 ktCO2e was derived from electricity purchased to power our buildings, while 4.9 ktCO2e was generated through the combustion of fossil fuel in SPU's vehicle fleets.

SPU's historic landfill emissions declined from 2.0 ktCO2e in 2020 to 1.6 ktCO2e in 2021. Finally, fugitive emissions and stationary combustion emissions were responsible for 0.5 ktCO2e and 0.7 ktCO2e in 2021, respectively.

Overall Key Takeaways

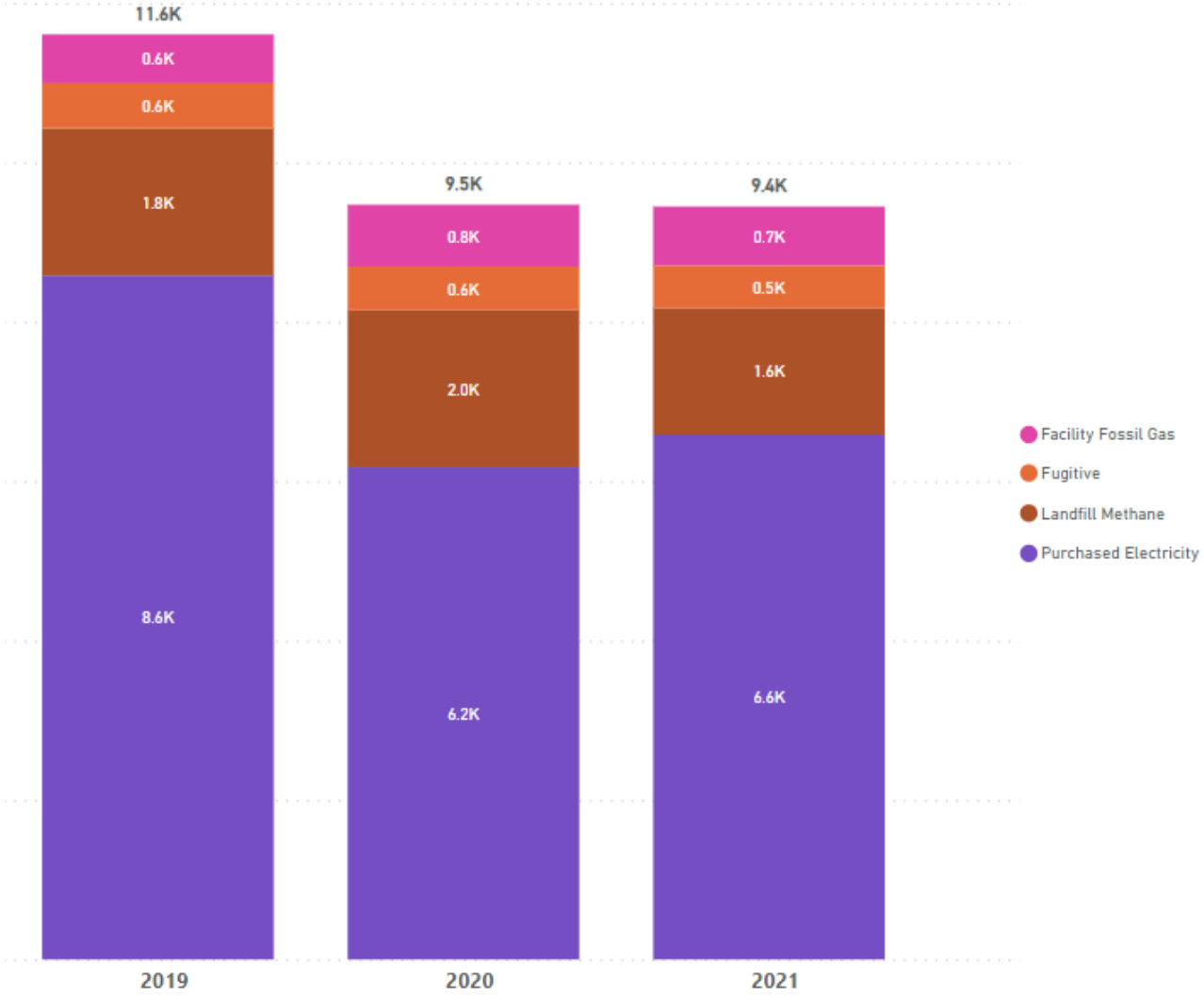
- **Overall emissions remained relatively stable between 2020 and 2021:** SPU's emissions increased by the equivalent of 300 metric tons of carbon dioxide – a 2.14% increase year-over-year. Compared to the 2.6 thousand metric ton decline between 2019 and 2020, the 2021 emissions year shows stable operational emissions trends.
- **Purchased electricity and fleet fuel emissions increased:** Purchased electricity emissions increased 6.45% from 6.2 ktCO2e to 6.6 ktCO2e, due to an increase in carbon intensity for electricity generated by PSE. Additionally, fleet fuel emissions rebounded to post-pandemic levels previously seen in 2019, leading to a year-over-year increase from 4.5 ktCO2e in 2020 to 4.9 ktCO2e in 2020.
- **A decline in landfill emissions offset other emissions increases:** Emissions generated from SPU's historic landfills declined 20% from 2.0 ktCO2e in 2020 to 1.6 ktCO2e in 2021. This decline helped keep reported emissions relatively stable, despite the overall increase in emissions related to purchased electricity and fleet fuels.

Figure 1: Overall Operational Emissions

4. Infrastructure, Historic Landfills, and Workforce Facilities

SPU's emissions derived from its infrastructure, historic landfills, and workforce facilities were nearly identical in 2021 to 2020. In 2020, our infrastructure, landfills, and workforce facilities generated the equivalent of 9,469.47 metric tons of carbon dioxide, while in 2021 these same sites generated the equivalent of 9,446.48 metric tons of warming emissions.

Fig. 2: Infrastructure, Historic Landfill, and Workforce Facilities Emissions



4.1 Purchased Electricity

Purchased electricity emissions increased 6% between 2020 and 2021, from 6.2 ktCO2e to 6.6 ktCO2e. This increase is likely due to changes in the composition of electricity purchased by SPU, as well as due to the increase in emissions intensity for electricity purchased from Puget Sound Energy.

Total kwh of electricity purchased decreased year over year, from 34.4 million kwh in 2020 to 33.6 million kwh in 2021. However, while total electricity purchased declined, SPU did purchase more electricity in 2021 from PSE than in 2020, increasing 5% from 14.6 million kwh to 15.3 million kwh. This increase likely contributed to part of the year-over-year increase observed in total purchased electricity emissions.

Fig. 3: Electricity consumed by Utility, in KWH

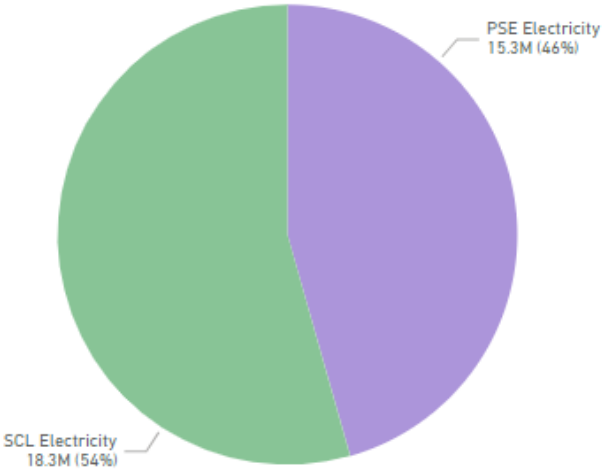
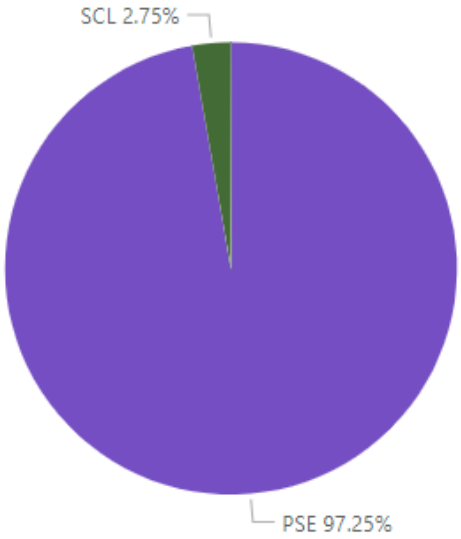


Fig. 4: Purchased Electricity Emissions Produced by Utility, in mtCO2e



As Seattle City Light's emissions intensity is so small compared to Puget Sound Energy, changes in electricity consumption from SCL sources have a negligible impact on the utility's overall emissions profile. While SPU purchased less electricity from SCL than in previous years, the impact of those improvements did not result in substantial changes to purchased electricity trends. It's important to note that improving energy efficiency – and using less electricity in aggregate – is still an encouraging trend. As SPU aims to be an energy efficient and energy aware utility, further improvements in reducing energy consumption should be pursued. However, until SPU can reduce electricity consumption associated with Puget Sound Energy, energy efficiency initiatives will not be associated with significant emissions reductions.

4.2 Facility Fossil Gas and Fugitive Emissions

SPU's emissions traced to facility fossil gas usage stayed consistent between 2020 and 2021. SPU emitted the equivalent of 739.25 metric tons of CO2 in 2021. This represents a decline of just 36.63 metric tons from 2020's emissions levels.

Similar to fossil gas emissions, SPU's fugitive emissions stayed flat, with an equivalent of 534.36 metric tons of CO2. This represents a total year-over-year reduction of just 15.73 metric tons compared to 2020.

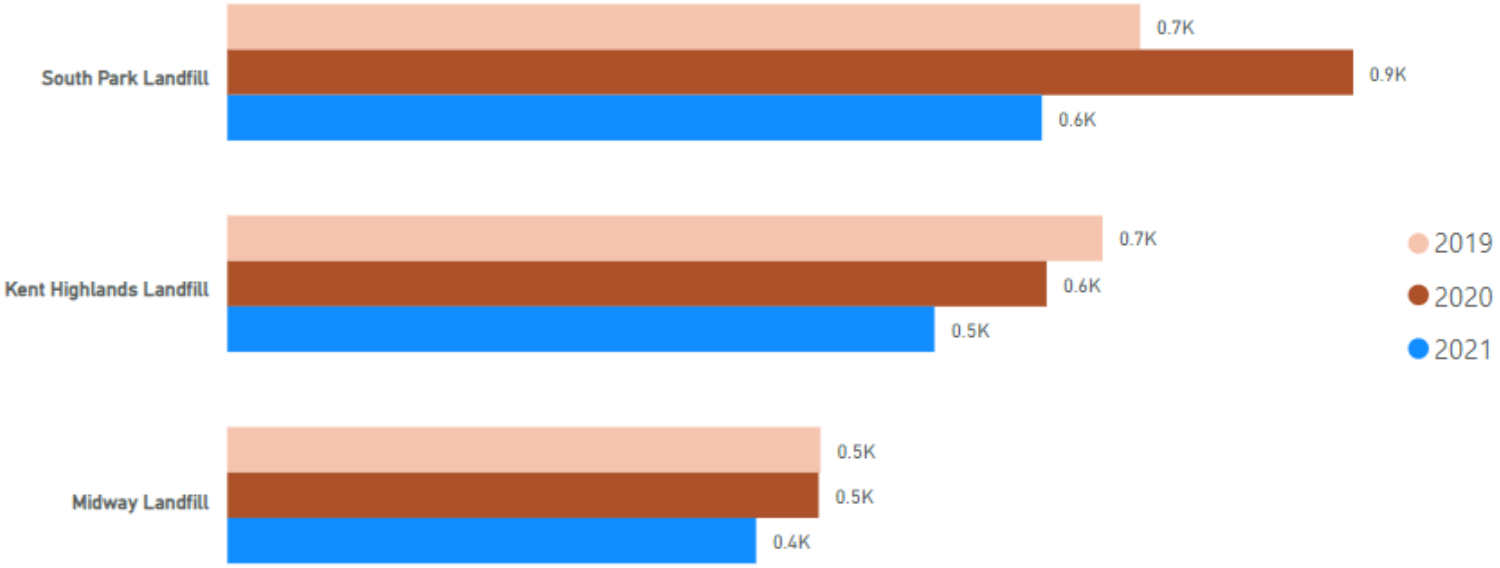
As SPU has not significantly changed any HVAC or MVAC systems, we do not expect to see significant emissions reductions. However, as SPU transitions some of its HVAC systems from fossil-gas powered systems to heat pumps over the next 10 years, we expect that we could see modest increases in fugitive emissions in the future, alongside declines in facility fossil gas. It will be important for SPU to invest in both effective monitoring of fugitive emissions alongside new HVAC systems, to best reflect the improvements that new heat pumps contribute towards SPU's overall emissions reductions goals.

4.3 Historic Landfills

Total historic landfill emissions declined from an estimated 2.0 ktCO2e in 2020 to 1.6 ktCO2e in 2021.

SPU's historic landfills release landfill gas through the natural decay of organic material disposed of within these landfills. To mitigate these emissions impacts, SPU installed a web of landfill gas collection systems at the Kent-Highlands and Midway Landfills. These collection systems route landfill gas to a flare system that destroys much of the methane mixed into the landfill gas, dramatically mitigating the warming impact of those two landfills. Combined with the estimated decline in total landfill gas emitted from these landfills, SPU recorded the lowest total of emissions for these sites on record in 2021: 0.5 ktCO2e for Kent-Highlands, and 0.4 ktCO2e for Midway.

Fig. 5: Historic Landfill Emissions



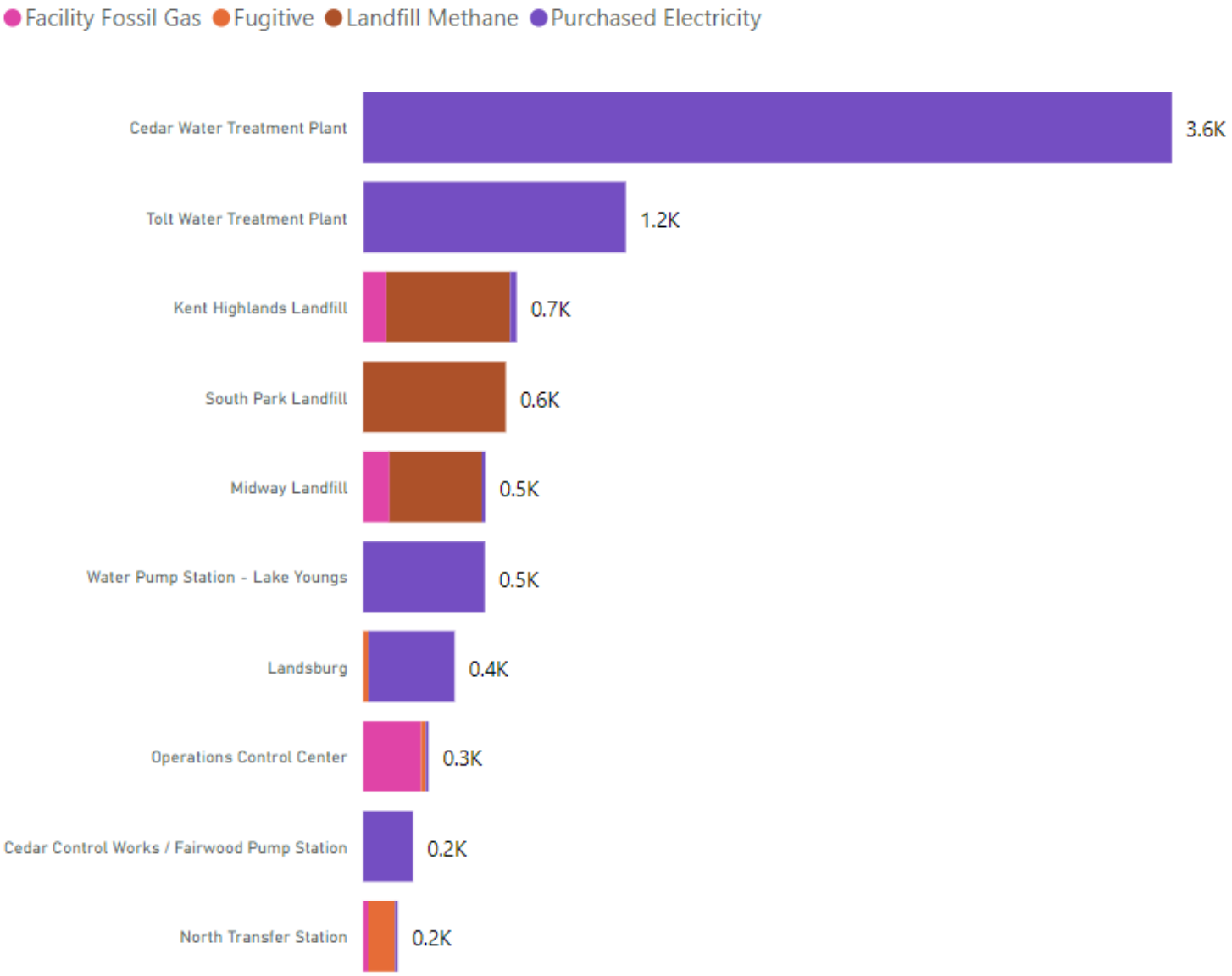
Our South Park landfill does not have a landfill gas collection system installed; as it is the smallest of the three landfills, a collection system on site is not considered to be effective as a mitigation solution. However, as the landfill releases methane directly into the atmosphere, the South Park landfill has the largest emissions profile of the three sites, releasing 0.6ktCO2e in 2021. This is still a substantial improvement compared to 2020, when the South Park Landfill released an estimated 0.9ktCO2e.

An important caveat to note is that all these landfill emissions totals are estimated through modelling that compares total volume of waste disposed in each site to the Interbay Landfill administered by the Seattle Department of Parks and Recreation. SPU uses this method because we don't have a system to accurately measure exact totals of landfill gas emitted at each landfill site. As such, these totals are estimations. As landfill emissions are widely variable from year to year, it's possible that the true total of emissions from the historic landfills SPU maintains could be significantly different than the amounts estimated in these reports.

SPU's historic landfills are on a long-term decline in total emissions. As organic matter decays over time, we expect that the total amount of landfill gas emitted each year will decline. The data in this inventory supports that long-term trend, despite annual fluctuations that might result in short-term increases.

4.4 Highest Emitting Facilities

Fig. 6: Highest Emitting Facilities



Similar to previous years, water treatment and historic landfills remained the facilities with the largest emissions profiles. The two treatment facilities are the largest sites on record, with the Cedar treatment facility emitting 3.6 thousand metric tons of CO2 emissions in 2021, and the Tolt treatment facility generating 1.2 thousand metric tons. The three historic landfills are the next three highest emitting facilities, with the Kent, South Park, and Midway landfills emitting 0.7 thousand, 0.6 thousand, and 0.5 thousand metric tons, respectively. A notable change from years prior is that the North Transfer Station is now our 10th highest emitting facility, replacing the water pump station at Lake Hills. Part of this change is due to the decline in emissions from our pump stations, due to shifts in usage and efficiency. But a secondary reason is that the North Transfer Station utilizes heat pumps in lieu of fossil gas furnaces. These heat pumps can leak refrigerants, which have extremely high warming potential and can contribute to

substantial warming even with very limited quantities of the refrigerant escaping. As our current protocol calculates the quantities of refrigerants released from these heat pumps through simplified estimation methods, it is possible that these results could overstate the emissions impact of these pieces of equipment.

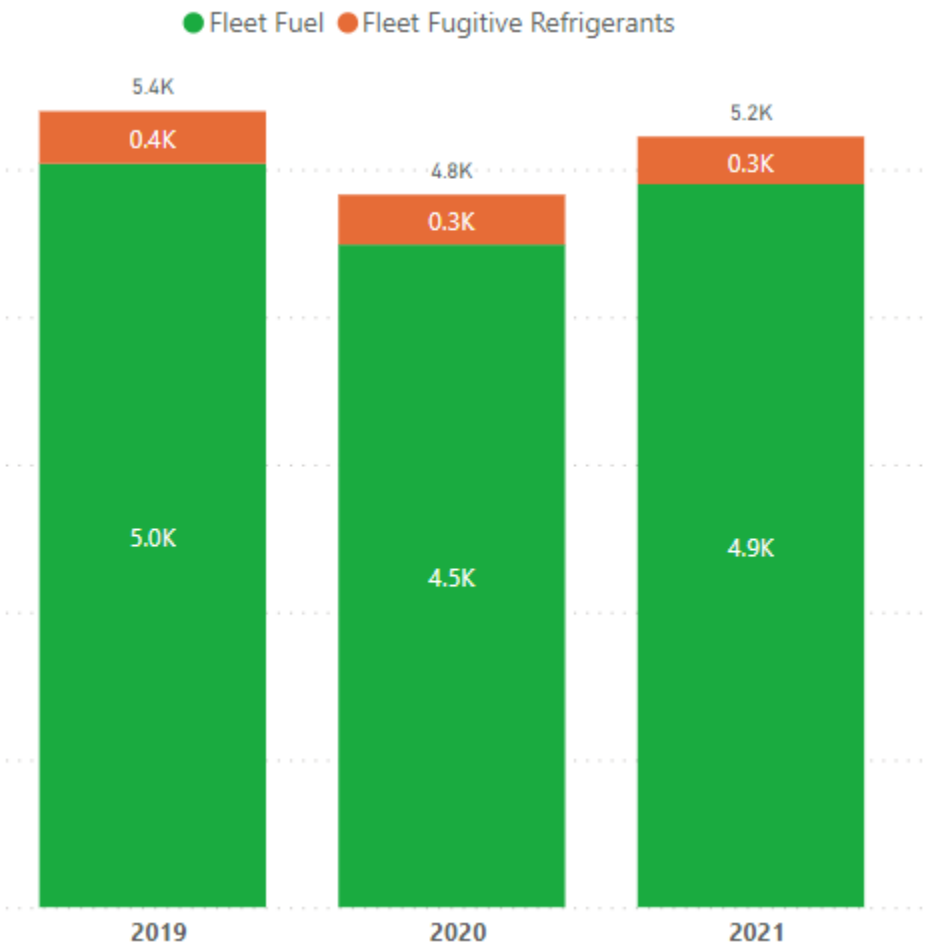
Key Takeaways

- **Despite using less energy in 2021, SPU recorded a year-over-year increase in emissions associated with purchased electricity. This is largely attributed to PSE's increase in emissions intensity compared to 2020.** Purchased electricity continues to be the utility's largest source of emissions, and the overwhelming majority of those emissions continue to be attributed to PSE until new sources of renewable energy are brought online.

5. Fleet and Equipment

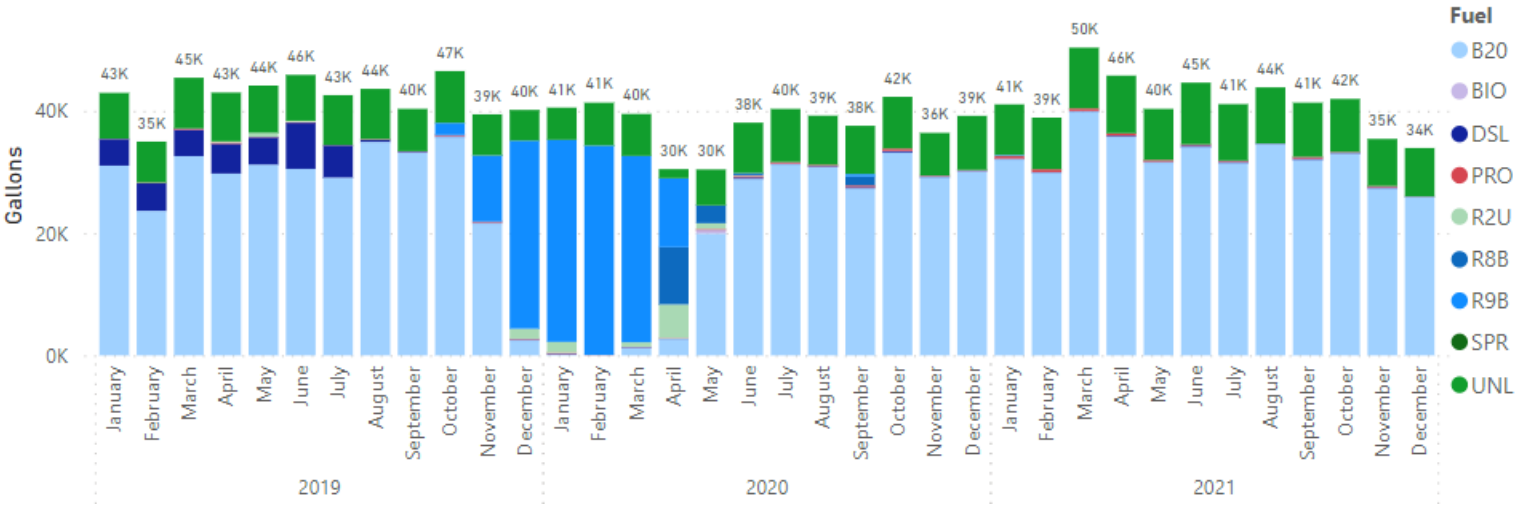
In 2021, SPU's vehicle fleet generated 5.2 ktCO2e, with 93% of that total coming from the combustion of fossil fuels, and 7% traced to the escape of fugitive emissions from air conditioning systems.

Fig. 7: Total Fleet Emissions



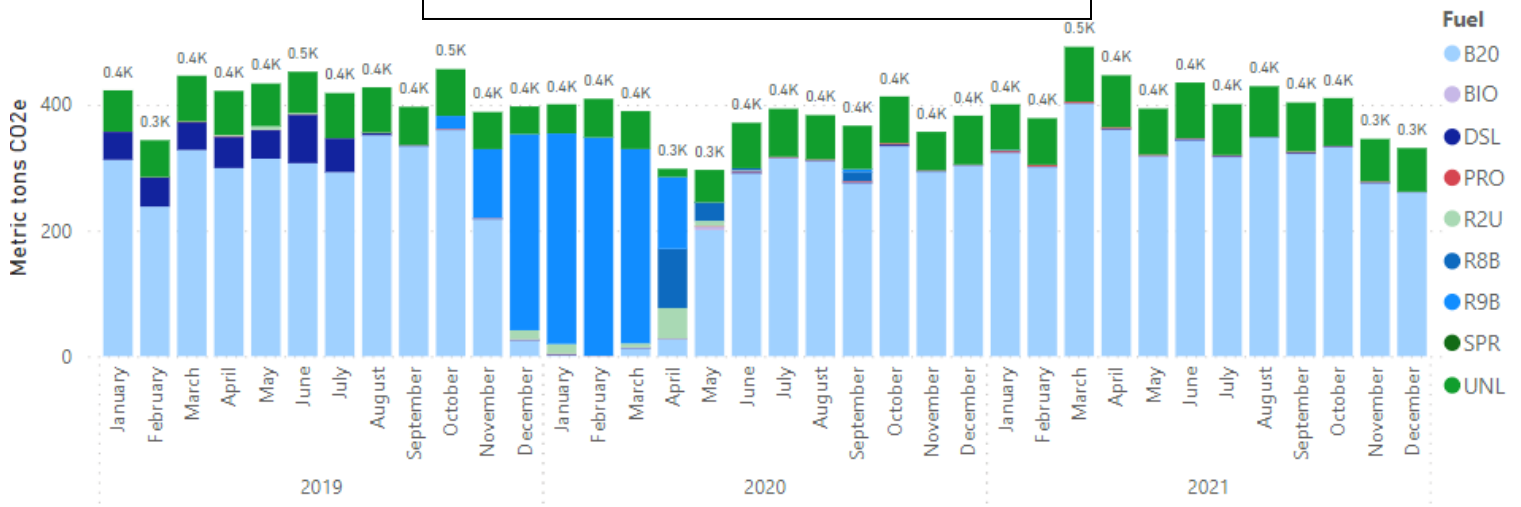
In 2021, SPU's fleet fuel consumption totals 499,000 gallons, representing a 9.7% increase over fuel use in 2020. Biodiesel accounted for 390,000 gallons (77%) of fuel consumed in 2021 and unleaded fuel was 106,000 gallons (21%). FAS manages both night fuel services and city fuel stations for the SPU fleet. In 2024, FAS is planning to transition from biodiesel to renewable diesel which is expected to further reduce emissions. While the use of biodiesel or renewable fuel blends is likely to improve the life-cycle emissions of fuels, the methodology that this inventory uses only examines the tailpipe emissions of each fuel. As such, it is likely that the life-cycle emissions of SPU's fuel consumption are less than the amounts described here. We are continuing to monitor for new methodologies that would allow us better estimate of life-cycle emissions of our liquid fuels.

Fig. 8: Fuel Consumption by Month and Type, in Gallons



This higher consumption of fuel corresponded with higher fuel emissions, totaling 4.9 ktCO2e. Monthly consumption trends showed a rebound to pre-COVID-19 emissions and consumption records; March of 2021, for example, is the highest-emitting month on record for SPU's vehicle fleet. Most of the rest of 2021 was consistently around 0.4 ktCO2e, aligning with the baseline set in 2019.

Fig. 9: Fuel Emissions by Month and Type, in mtCO2e



However, the end of 2021 saw a noteworthy decline in both fuel consumption and emissions. November and December of 2021 recorded two below average fuel consumption totals - and thus, lower emissions - in our data set, only rivaled by February of 2019, as well as the pandemic-impacted April and May of 2020.

Key Takeaways

- **Fleet emissions rebounded to pre-pandemic levels for most of 2021:** As normal operations began to resume among SPU's workforce, fuel consumption jumped back up to levels in-line with 2019 until the very end of the year. This corresponded to an increase in vehicle emissions as well.
- **There are potentially encouraging signs that SPU's fuel emissions may be starting to decline:** November and December of 2021 showed notable decreases in fuel consumption and emissions, with the only months reporting lower emissions being March and April of 2020. Outside of the acute phase of the COVID-19 pandemic, only one other month – February of 2019 – reported similarly low levels of fuel consumption, and no other month with regular operating conditions reported lower fuel consumption than 2021.

6. Analysis

6.1 Trends and Future Expectations

With data from three annual GHG inventories now released, there are some early emerging trends that should be considered in long-term decarbonization policy at SPU. While three years' worth of data is a limited sample size – and there remains considerable uncertainty about future emissions – several early conclusions are worth considering.

- **Emissions intensities for purchased electricity are likely to continue declining:** Emissions intensities have declined consistently since 2019 for both of our electricity providers, with the most notable decline emerging from PSE between 2019 and 2020. While our overall electricity consumption has not significantly changed since 2019, we anticipate that ongoing efforts to reduce emissions associated with generating electricity will persist, for several reasons:
    - While SCL is already a carbon-neutral electric utility, PSE has also pledged to be carbon neutral by 2030 and produce entirely clean energy by 2045. This trend towards lower-carbon emissions will have a positive impact on our own emissions reduction efforts.
    - Washington State and Federal policy is incentivizing a transition to renewable energy. Bills like the Climate Commitment Act and the Inflation Reduction Act are likely to provide positive pressure on further emissions reductions, ensuring that the improvements we have already recorded will continue to persist into the future.
- **Vehicle fuel emissions will be challenging to completely abate, but SPU should see improvements in the coming years as emissions abatement efforts take effect:** As SPU's existing vehicle fleet is comprised mostly of fossil-fuel powered vehicles that can have a lifespan of a decade or longer before replacement, we anticipate that a transition to electric vehicles will likely be gradual in nature. Additionally, it is unlikely that electric alternatives for certain heavy-duty vehicles – such as vactors - will reach a level of technological maturity that is acceptable for SPU's operational requirements before 2030. However, SPU has already taken significant steps to begin electrifying our fleet, and new electric models continue to become available that will meet business needs, especially for our light fleet operations.
- **Historic Landfill emissions are expected to decline long term:** SPU's historic landfills no longer accept solid waste and are in a process of decomposing the organic matter disposed of at these sites. We expect that landfill gas emissions from these historic landfills will decline long term, despite occasional fluctuations within individual years.

6.2 Areas of Uncertainty / Risks

While the overall trend is likely to lead to decreasing emissions, there are certain areas of uncertainty that could both complicate SPU's emissions goals, and provide new opportunities for additional emissions reductions:

- **SPU emissions are closely linked to SCL and PSE's electrical emissions profiles:** Both the electricity generation emissions profiles for SCL and PSE can fluctuate each year. While SCL utilizes hydropower for a large majority of their power supply, PSE also relies on fossil gas plants, coal plants, and wind power to supplement their hydropower supply. As a result, SPU should expect that purchased electricity emissions could fluctuate annually; regional precipitation patterns, coal and fossil gas market developments, and renewable energy development could all create unexpected increases or decreases in annual emissions.

- **Market changes for renewable power technologies could provide new opportunities for decarbonization**: With federal incentives supporting new investments in renewable power manufacturing, components like solar panels and electric vehicles are both becoming more numerous in the market and more affordable. Projects like renewable energy generation capacities operated by SPU, or further fleet electrification, might become more variable as the market for these assets matures.

Appendix

Appendix 1: Methodology

The 2021 operational emissions inventory uses the same methodology established in the 2019-2020 GHG Inventory Report. SPU uses the Local Government Operations Protocol (LGOP) as established by The Climate Registry (TCR). Analysis is limited to Scope 1 and Scope 2 emissions.

Scope 1 emissions are defined as emissions released directly into the atmosphere through the combustion of fossil fuels. These emissions are generated through the operation of our vehicle fleet powered by fossil fuels, as well as through the combustion of fossil gas to heat our facilities. Scope 1 emissions also include fugitive emissions escaping from our facilities; historic landfill emissions as well as HVAC and MVAC emissions are both included in this category.

Scope 2 emissions are related to emissions that SPU is indirectly responsible for through the purchasing of electricity from Seattle City Light and Puget Sound Energy.

Our 2019-2020 GHG Inventory Report included some limited Scope 3 emissions, including analysis on employee commutes, solid waste collection trucks, and business travel. While these analyses were useful as part of our initial analysis, they are not considered part of our operational inventory, and are not included in this report.

Emissions factors for liquid fuels and fugitive emissions are derived from The Climate Registry. Emissions factors for electricity emissions are supplied by Seattle City Light and Puget Sound Energy.