SKOKIE GREENHOUSE GAS INVENTORY

JULY 2022

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EXECUTIVE SUMMARY

At the request of the Village of Skokie, Delta Institute conducted a baseline greenhouse gas inventory for the Village in the fall of 2021. An updated report was produced in the summer of 2022, integrating a different methodology for transportation emissions in collaboration with paleBLUEdot, LLC. This inventory includes emissions that are directly related to community actions and provides a starting point to develop initiatives that will reduce or eliminate emissions in the near, mid, and long term for the Village, its businesses, and residents.

Reducing greenhouse gas emissions is critical to avoid the worst effects of climate change and keep global temperature increases below 1.5° C. To support this goal, Delta has identified areas for improvement and strategies the Village may consider, in partnership with its residents and businesses.

This report identifies emissions within the Village boundary, describes emissions not included in the inventory but are nevertheless important to address, and recommends several strategies offering the greatest potential widespread benefits.

The inventory shows that per capita emissions for the Village, 11 tCO_2e, are comparable with other Cook County emissions (excluding Chicago) and to other similar communities, but lower than average emissions throughout the United States for communities in similar climates. However, the Village's per capita emissions are higher than many countries with similar climates and therefore represents an opportunity to pursue substantial reduction strategies as part of long-term planning efforts. This document provides a starting point for developing aggressive greenhouse gas reduction targets and plans for achieving them.

About Delta Institute

Established in 1998, Delta Institute is a Chicago-based nonprofit organization that collaborates with communities to solve complex environmental challenges across the Midwest. We envision a region in which all communities and landscapes thrive through an integrated approach to environmental, economic, and social challenges.

As a 501c3 nonprofit with a 2021 Platinum Seal of Transparency from GuideStar, Delta serves as a trusted advisor, technical provider, and project implementation expert for partners across the public, private, nonprofit, and community sectors. We rely on both philanthropic and earned revenue, specifically through grants, charitable contributions, and fee-for-service contracts.

Our work takes us to cities like Chicago, St. Louis, Gary, and Milwaukee; to Great Lakes coastal towns; and to rural communities with thousands of acres of farmland and waterways.

Visit us online at www.delta-institute.org.

This document and the tools provided aim to be action oriented and to provide the most current, correct, and clear information possible. However, some information may have changed since publication. We encourage practitioners to reach out to us at delta@delta-institute.org with any questions or corrections, or to discuss implementation challenges.

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GREENHOUSE GAS EMISSIONS INVENTORY OVERVIEW

Definitions

Greenhouse Gas (GHG) - Any of various gaseous compounds (such as carbon dioxide or methane) that absorb infrared radiation, trap heat in the atmosphere, and contribute to the greenhouse effect ("Greenhouse Gas", n.d.).

Global Warming Potential (GWP) - The potential of different greenhouse gases to produce the greenhouse effect as compared to carbon dioxide, which has a GWP of 1 (U.S. Environmental Protection Agency, 2021). Equivalencies for relevant greenhouse gases are listed in Table 1.

Carbon Dioxide Equivalent (CO_2e) - The GWP of a specific greenhouse gas expressed as a ratio of equivalent warming potential to CO_2 over a period of time. E.g., methane has a GWP of 28 - 36 over 100 years (U.S. Environmental Protection Agency, 2021).

Table 1. Global Warming Potential (GWP) of Common Greenhouse Gases

Gas Name	Gas Symbol	CO_2e	Residence Time (years)	Source
Carbon Dioxide	CO_2	1:1	1,000s	Fossil fuel combustion
Nitrous Oxide	N_2O	265:1	100	Crop production, fossil fuel combustion
Methane	CH_4	28:1	100	Livestock production, natural gas fugitive emissions, anaerobic decomposition of organic material (landfill)
Chlorofluorocarbons (CFCs)	CCl_nF_n	5,820 - 13,900:1	100	Refrigerants (R11, R12, etc.)
Hydrofluorocarbons (HFCs)	CH_nF_n	4 - 12,400:1	14.6	Refrigerants (R22, R404A, etc.)
Hydrochlorofluorocarbons (HCFCs)	$CHCl_nF_n$	79 - 1,980:1	14	Refrigerants (R134, R410A, etc.)

Source: U.S. Environmental Protection Agency, 2021

When reviewing emissions, the weight of an activity is considered by its GWP. For example, reducing refrigerant use can have a larger impact on GHG emissions than reducing electricity use because the GWP of certain refrigerants is greater than the GWP of burning fossil fuels for electricity generation. Further, understanding how technology will change (e.g., certain refrigerants are no longer allowed to be used in new commercial equipment after 2024) will help guide the Village in developing strategies and plans to reduce its greenhouse gas emissions. All emissions in this report are reviewed on a 100-year timeframe. However, certain refrigerants and other emission sources may benefit from a review with a shorter time frame. This document highlights scenarios in which available strategies should be reviewed to consider these factors.

Inventory Boundaries

A GHG emissions inventory involves setting boundaries based on factors within the control of a user or source and determining how best to allocate emissions to each source. Some sources are easier to calculate than others because source emissions are known and can be modeled (either as fuel purchases or metered consumption). Other emissions are harder to calculate and more complicated to model. Throughout this document, emissions are calculated and the fidelity of the data to estimate emissions for the Village is reported. A more extensive review of emissions from sectors may be conducted in the future to develop low-carbon transition plans. For this document, a broad review was needed to set a baseline.

This document follows the Global Protocol for Community Scale Greenhouse Gas Inventories and includes required emissions sources. Where possible, emissions from other sources are estimated. Emissions calculations are documented. Emissions are broken down into scope 1, scope 2, and scope 3 emissions, which span sources like stationary operations, transportation, and waste. Inventory boundaries are explained in more detail below.

Scope 1

Scope 1 emissions refer to emissions from stationary combustion, fugitive emissions and mobile combustion. Scope 1 emissions are primarily from burning fossil fuels for space and process heating. Primary GHG reported from stationary combustion are CO_2, N_2O, and CH_4. Fugitive emissions include refrigerants and CH_4 emissions during process or transport. Mobile combustion emissions are from transportation and primarily include CO_2, N_2O, and CH_4. For the purposes of this inventory, Scope 1 emissions are “GHG emissions from sources located within the [Village] boundary” (Greenhouse Gas Protocol, n.d., pg. 11).

Scope 2

Scope 2 emissions are indirect emissions from purchased energy. They result from the activities of the reporting organization but are emitted elsewhere. The most common reported Scope 2 emission is generated electricity. Its primary GHGs are CO_2 and N_2O, though other criteria pollutants are involved in the burning of fossil fuels for electricity generation. For the purposes of this inventory, Scope 2 emissions are “GHG emissions occurring as a consequence of the use

of grid-supplied electricity, heat, steam and/or cooling within the [Village] boundary" (Greenhouse Gas Protocol, n.d., pg. 11).

Scope 3

Scope 3 emissions are indirect emissions from all other sources, including waste management, purchasing, travel, and other supply chain-related activities. For the purposes of this inventory, Scope 3 emissions are "all other GHG emissions that occur outside the city boundary as a result of activities taking place within the [Village] boundary" (Greenhouse Gas Protocol, n.d., pg. 11). An exhaustive inventory of Scope 3 emissions is a longer-term undertaking and requires data collection and analysis beyond the scope of this inventory. Where data is available, Scope 3 emissions have been calculated; where not available, they are estimated based on publicly available data sources from similar sources. This inventory covers the BASIC reporting totals as specified by the Global Protocol for Community-Scale Greenhouse Gas Inventories (Greenhouse Gas Protocol, n.d., pg. 12).

COMMUNITY CHARACTERISTICS

The Village of Skokie is a municipality within the Chicago-Naperville, IL-IN-WI Metropolitan Statistical Area (MSA) bordering the north side of Chicago in Illinois. Skokie has 17,865 owner-occupied households and 7,296 renter-occupied households. Approximately 67 percent of households are families. The Village has more than 250 large institutions and industrial businesses including retail, educational, healthcare and manufacturing (Village of Skokie, 2021).

Skokie's population is split among 14 census tracts. Its residential population is estimated in 2021 to be 67,824, with an average household size of 2.82 and a median age of 43.7. Skokie has two zip codes, 60076 and 60077, with a population density of 6,438 per square mile (United States Census Bureau, n.d.). The average house size in Skokie is 1,860 sq ft versus 2,301 sq ft for the U.S (Cook County Government, 2020), (Statista, 2020). Relevant home sections analyzed are provided in Table 2. Residents have a slightly longer commute than the U.S. average (27.9 minutes in 2019 versus 25.5), and primarily drive alone (69.7 percent) (DataUSA, n.d.). Most households own two cars.

Table 2. Cook County Assessor Boundaries for Skokie Single Family Residential Properties

Zip Code	Section	Boundary Street (North)
60077	9	Central
60077	16	Golf
60077	21	Dempster

60077	28	Oakton
60077	33	Touhy
60076	10	Central
60076	15	Golf
60076	22	Dempster
60076	27	Oakton

RESULTS

Community activities within Skokie produce approximately 726,364 $MTCO_2e$ annually, with stationary emissions as the largest source. The per capita emissions produced is approximately 11 $MTCO_2e$ annually. This calculation estimates all activities within the boundaries outlined above. Emissions sources have been broken down by categories as defined by the Global Protocol for Community-Scale Greenhouse Gas Inventories and further by emissions scope. Data analysis uses information from 2020 except for rail transportation, as 2020 data was not available. Given the Covid-19 pandemic's impact on public and private life, 2020 emissions totals were likely affected. Continued tracking going forward will help explain these immediate impacts and any long-term shifts because of the pandemic.

Table 3. Community Emissions for the Village of Skokie ($MTCO_2e$)

	Scope 1	Scope 2	Scope 3	Total
Stationary	199,518	231,365	N/A	430,883
Transportation	256,035	1,109	N/A	257,144
Waste	N/A	N/A	38,338	38,338
Total	455,553	232,474	38,338	726,365

Figure 1. Community Emissions Breakdown by Scope

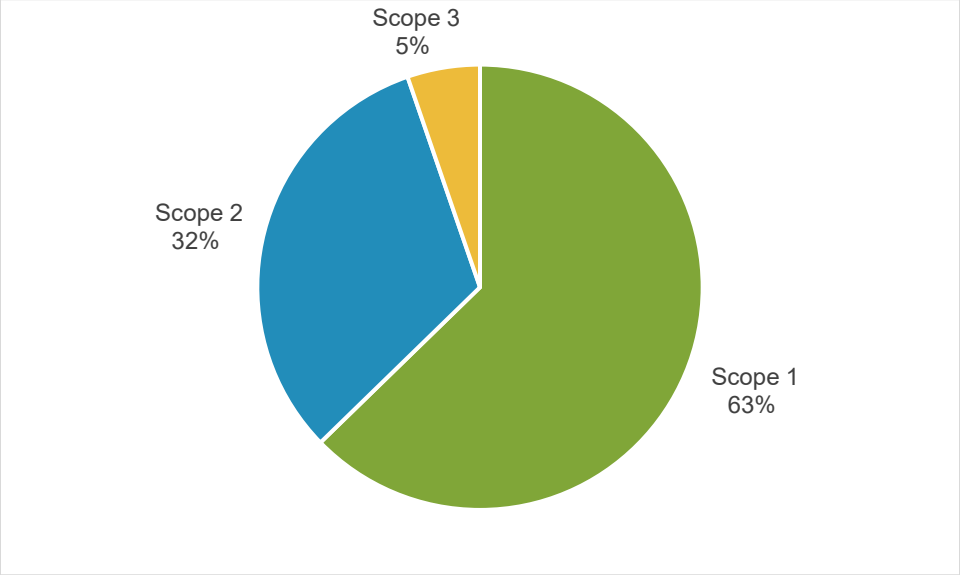
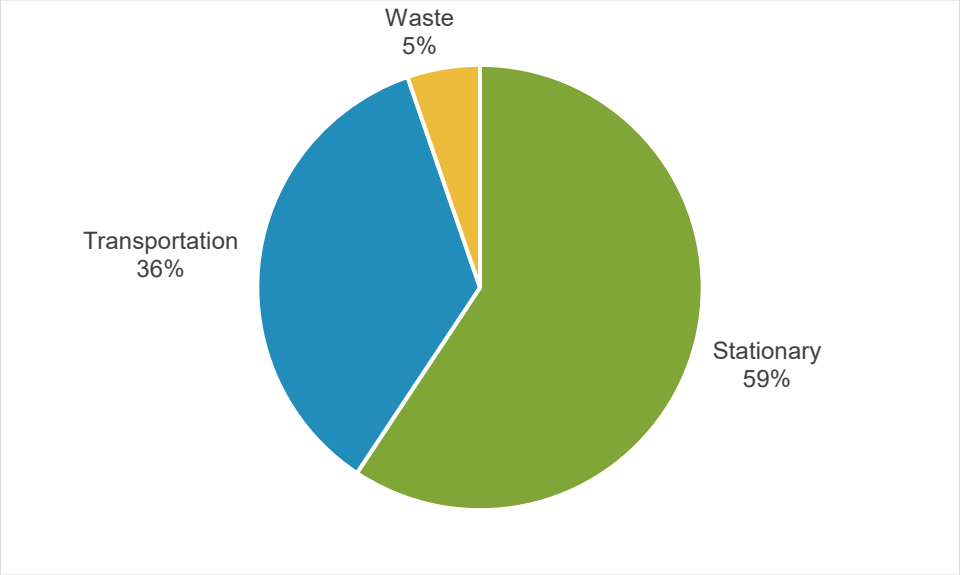


Figure 2. Community Emissions Breakdown by Source



In addition to analyzing the community at large, a separate inventory was compiled for Village operations. Village operations produced approximately 7,226 $MTCO_2e$, with stationary sources as the leading source of emissions. The Village operates six facilities with different use profiles, as well as a refuse barn and two water towers.

Table 4. Village Operations Emissions for the Village of Skokie ($MTCO_2e$)

	Scope 1	Scope 2	Scope 3	Total
Stationary	1,397	3,412	N/A	4,809
Transportation	1,869	0	N/A	1,869
Waste	N/A	N/A	548	548
Total	3,266	3,412	548	7,226

Figure 3. Village Operations Emissions Breakdown by Scope

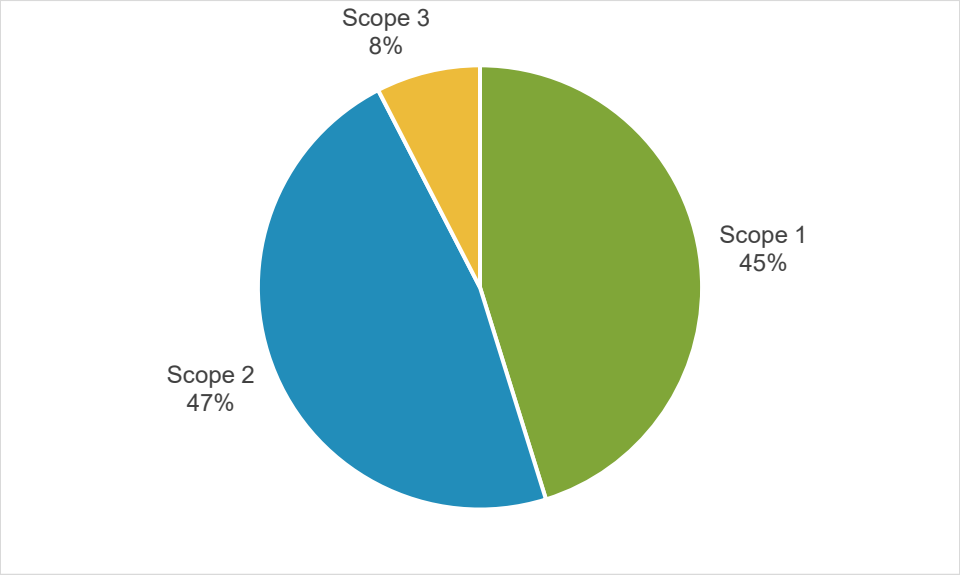
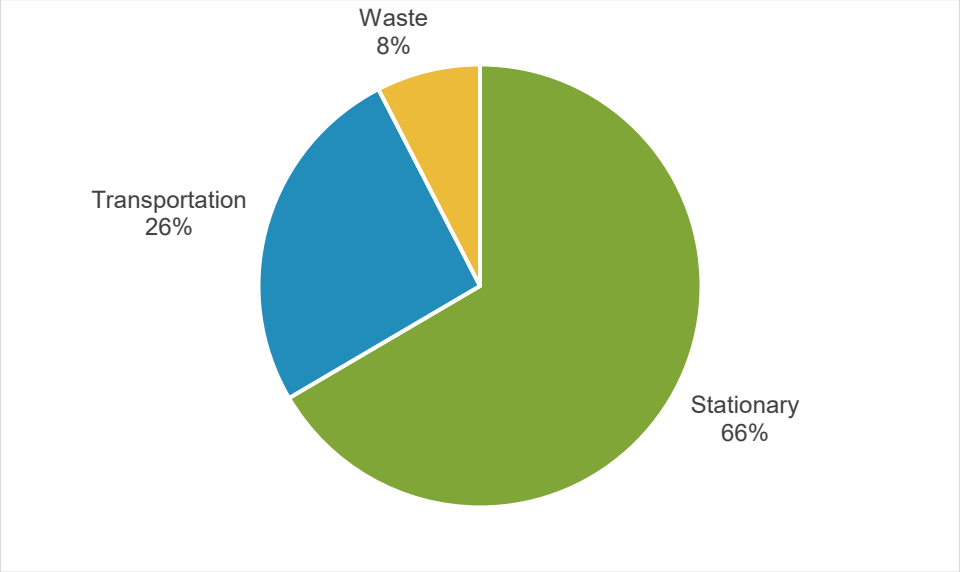


Figure 4. Village Operations Emissions Breakdown by Source



Stationary Emissions

Community Emissions

Total stationary emissions for the Village of Skokie were 430,883 $MTCO_2e$. Of these, 64 percent came from residential energy usage and 30 percent came from commercial usage. Manufacturing and industrial usage made up the smallest percentage of Skokie's energy use at 6 percent. By scope, 46 percent of emissions came from Scope 1 sources, while 54 percent of emissions came from Scope 2 sources. Most of Scope 1 emissions in the Village are from natural gas use for space heating.

Table 5. Stationary Community Emissions for the Village of Skokie ($MTCO_2e$)

	Scope 1	Scope 2	Total
Residential	113,790	160,307	274,097
Commercial	67,195	63,906	131,101
Manufacturing & Industrial	18,533	7,152	25,685
Total	199,518	231,365	430,883

Figure 5. Stationary Community Emissions Breakdown by Scope

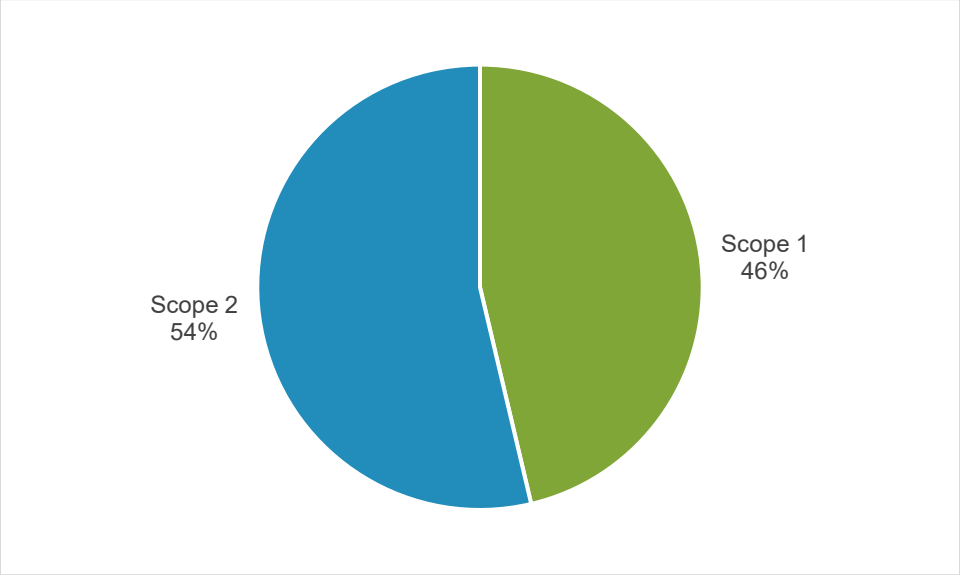
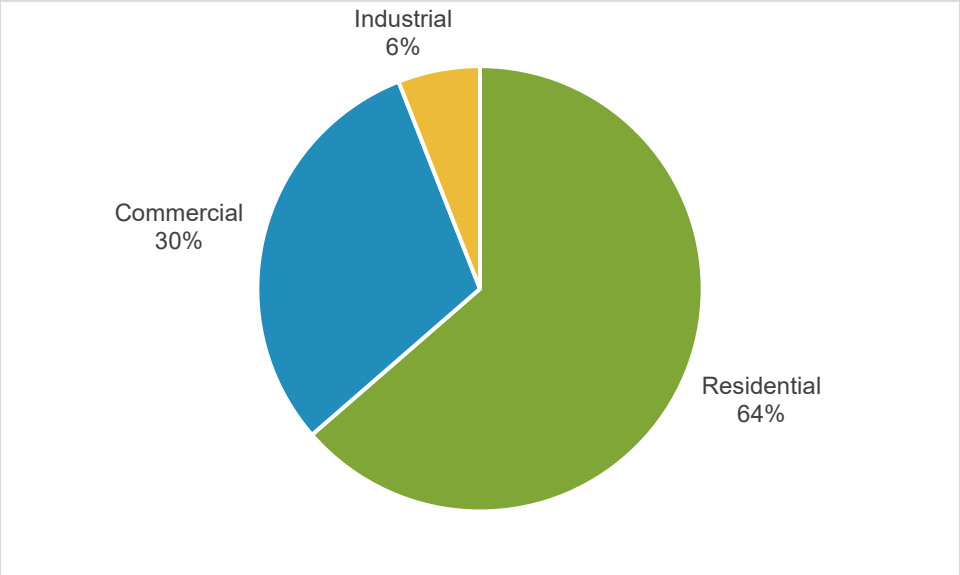


Figure 6. Stationary Community Emissions Breakdown by Source



Village Operations Emissions

Total stationary emissions for Village operations were 4,809 $MTCO_2e$. Stationary emissions came from natural gas usage (1,394 $MTCO_2e$) and electricity usage (3,412 $MTCO_2e$) in facilities, falling into scope 1 and scope 2 emissions respectively. Less than 1 percent of total stationary emissions came from operating diesel-fueled backup generators (3 $MTCO_2e$).

Table 6. Stationary Village Operations Emissions for the Village of Skokie ($MTCO_2e$)

	Scope 1	Scope 2	Total
Facilities	1,394	3,412	4,806
Backup Generators	3	N/A	3
Total	1,397	3,412	4,809

Transportation Emissions

Community Emissions

Transportation emissions for the Village of Skokie totaled 257,144 $MTCO_2e$. On-road vehicle emissions accounted for over 99 percent of emissions, with less than 1 percent attributed to electric rail. Electric rail emissions come from the operation of the CTA Yellow Line through Skokie

Table 7. Transportation Community Emissions for the Village of Skokie ($MTCO_2e$)

	Scope 1	Scope 2	Total
On Road	256,035	0	256,035
Rail	0	1,109	1,109
Total	256,035	1,109	257,144

Village Emissions

Village operation produced 1,869 $MTCO_2e$ in 2020 while operating its vehicle fleet. These emissions are part of the Village's Scope 1 emissions due to the fuel source as shown in Table 4. The Village's fleet uses both diesel and gasoline for its vehicles.

Waste Emissions

Community Emissions

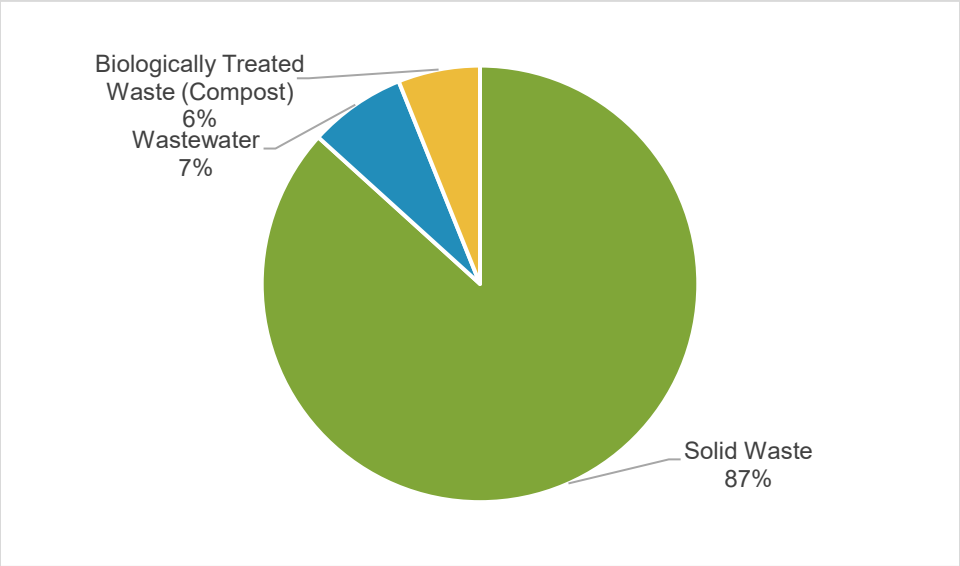
Waste emissions, coming from solid waste, biologically treated waste (compost), and wastewater generated within the Village of Skokie totaled 38,338 $MTCO_2e$. Most of these

emissions were from solid waste generated within Skokie, making up 87 percent of the total emissions, followed by wastewater (7 percent) and biologically treated waste (6 percent).

Table 8. Waste Community Emissions for the Village of Skokie ($MTCO_2e$)

	Scope 3
Solid Waste	33,175
Wastewater	2,801
Biologically Treated Waste	2,363
Total	38,338

Figure 7. Waste Community Emissions Breakdown by Source



Village Emissions

Waste emissions for Village operations – refuse and recycling collected at Village facilities – totaled 548 $MTCO_2e$.

EMISSIONS TRENDS

The trend of emissions for the Village of Skokie cannot be established at this time, as this report captures the first full year of inventoried emissions and sets a baseline for future reporting. However, regional and national trends are reported below to help the Village determine its likely

emissions trends in the short, medium and long term. This document may be updated annually with provided calculators to track emissions over time.

EMISSIONS REDUCTIONS TARGETS

Science-Based Targets

Science-based targets (SBTs) are GHG reduction targets intended to keep the increase of global mean temperature well-below 2°C above pre-industrial levels and pursue efforts to limit warming to 1.5°C. They follow a protocol developed by the Science Based Targets Initiative, a partnership of CDP, the United Nations Global Compact, World Resource Institute, and the World Wide Fund for Nature to address climate change through emissions reductions. Though directed toward corporations, the initiative's methodology is useful in setting realistic and achievable targets for municipalities (Science Based Targets, n.d.).

Setting a SBT involves baselining Scope 1 and Scope 2 emissions to set a base year (the most recent year of data) and determining a target year by which the Village would achieve reductions to help limit warming to 1.5°C. Scope 3 emissions targets are required if more than 40 percent of emissions are Scope 3. Additional emissions reductions would exceed this target. Target years should include short (< 5 years) medium (5 to 15 years) and long term (> 15 years) benchmarks (Science Based Targets, 2020, pg. 6).

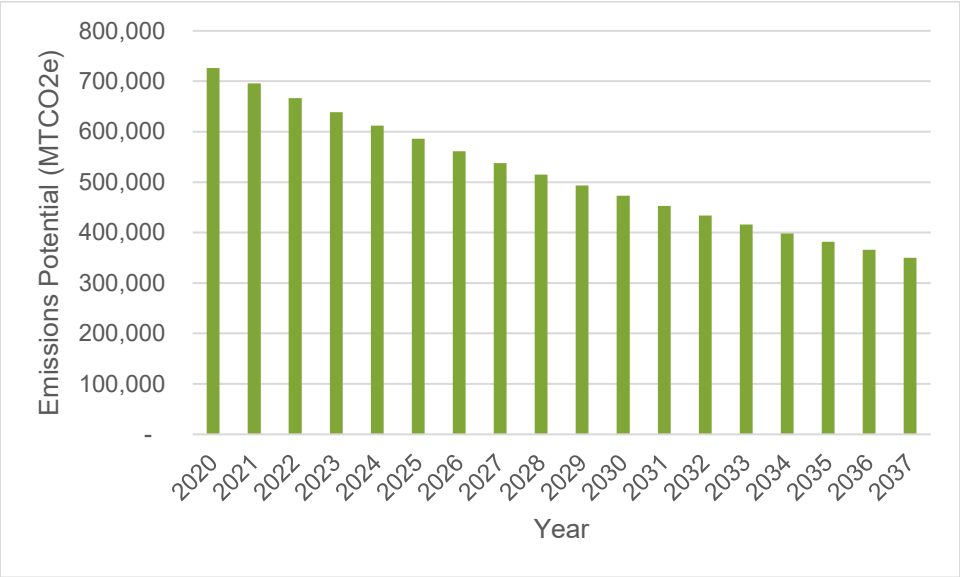
Reductions must be absolute and can be either delineated by scope or combined. Offsets and avoidance measures do not count toward meeting targets (e.g., reducing fugitive emissions from refrigerants does not count, but eliminating refrigerant-containing equipment through more efficient design would). Renewable energy procurement can count toward reductions in Scope 2 emissions if purchasing is equal to 80 percent of annual emissions by 2025 and 100 percent by 2030.

The most basic approach, used herein to develop preliminary target estimates, involves setting a 4.2 percent annual linear reduction to align with a 1.5°C warming limit. Table 9 demonstrates reduction targets using this approach.

Table 9. Science Based Targets by Term 4.2 Percent Annual Linear Reduction

Term	Target Reduction	Target Year
Short (5 year)	21%	2027
Medium (10 year)	42%	2032
Long (15 year)	63%	2037

Figure 8. Emissions Trend Potential Following SBTs over short-, medium-, and long-term



Strategies for reducing emissions are included in the proceeding sections, along with their approximate effect. Individual strategies for emissions scopes can be developed that, in aggregate, can achieve SBTs. Developing a low-carbon transition plan will help identify realistic and achievable reduction strategies.

Potential SBT Reduction Strategies

There are several emissions reduction strategies the Village may consider. An emissions inventory provides information on where focused reduction efforts may have the most effect. There are three main energy user categories in Skokie (Village operations, Residential, and Commercial) that can be targeted for greenhouse gas reduction programs.

Village of Skokie Operations

The Village operates six buildings, used for public works, parks, police, fire, and administration. There are five strategies the Village should consider taking to target emissions reductions in its buildings.

Village Operations - Stationary Strategies

Strategy 1: Set up EnergyStar Portfolio Manager for Village-owned properties.

Create a portfolio and manage each building separately in the portfolio to track natural gas consumption, electricity consumption, water consumption, and waste production. EnergyStar Portfolio Manager provides conversion for greenhouse gas emissions, as well as energy use intensity for each building.

Data entry can be automated for some utility application program interfaces (APIs), scraped

from billing systems with software, or manually entered as part of monthly bill collection.

Energy consumption reductions from benchmarking are typically 4 percent to 10 percent. The more considerable effect is that businesses begin to understand and address their emissions.

Strategy 2: Engage with Nicor Gas and ComEd to take advantage of energy efficiency program incentives.

Both Nicor Gas and ComEd provide energy efficiency program incentives to municipalities through the Nicor Gas Energy Efficiency Program and the ComEd Energy Efficiency Program, respectively. Both programs offer assessments, rebates, and educational opportunities for institutions. As energy efficiency goals for both utilities continue to increase, rebates and program options will continue to improve. Engaging with program providers is the first step in developing improvement plans. These plans include demand response and renewable energy efforts in addition to efficiency programs.

Strategy 3: Solar photovoltaic installations

After exhausting energy efficiency efforts, Skokie can look at renewable energy installations at its facilities to further reduce consumption and peak demand. Simple payback and return on investment for solar are typically within the useful life of the installation, making them cost effective for buildings that will still be operating in 25 years. The greenhouse gas benefit of distributed onsite generation is greater than purchasing renewable energy when the loss to line resistance from regional generation is taken into account. However, each installation must be reviewed independently as complicated systems could increase the installation cost and reduce this benefit.

Strategy 4: Refrigerant inventory and maintenance

The Village has provided an inventory of its refrigerant-containing equipment, which shows a number of older systems with R-22, a refrigerant that is no longer in use. As these systems are replaced, the Village should review emerging low-GWP refrigerants and conduct a refrigerant greenhouse gas inventory to track reductions.

Strategy 5: Electrification

Electrification reduces greenhouse gas emissions as the grid continues to use more renewable energy, replacing fossil fuels as a primary fuel source for space heating. Though the greenhouse intensity of burning natural gas onsite is less than the current source energy mix, including losses, as renewable energy becomes more prevalent the reductions become more considerable, especially when taking into account fugitive methane emissions of natural gas operations.

Strategy 6: Increase organic waste diversion

In addition to expanded organic waste diversion through composting, the Village should strive for close to 100 percent of landscape waste to be diverted from landfills.

Village Operations - Mobile Strategies

Strategy 1: Electrify Village fleet vehicles.

Over the past few years electric cars have increased in range, and battery technology has improved to handle fast-charging infrastructure. As Skokie replaces fleet vehicles at the end of their useful lives, the Village should review electric options to eliminate emissions, especially for light duty vehicles. It should plan a fleet vehicle study to determine charging infrastructure that would best serve the Village over the next 10 to 15 years, planning for an all-electric fleet as technology continues to improve.

Skokie is in the ComEd distribution service territory, which is part of the PJM independent system operator (ISO), a regional transmission company that supplies power to distribution utilities from large generators such as coal, natural gas, wind, and nuclear generation facilities. As the PJM energy mix continues to include more renewable energy, this strategy will provide duplicate reduction opportunities, as it will draw increasingly on renewable energy power sources while providing increased demand for electricity. PJM is required to purchase the most cost-effective power first; currently that is renewable energy. As a municipal aggregation provider, the Village can choose to source renewable energy, which can eliminate emissions from stationary and mobile sources.

Strategy 2: Electrify maintenance equipment

Though small, the emissions from fossil-fuel burning maintenance equipment are an easy to remedy emissions source. Yard and building maintenance equipment have electric replacements that reduce maintenance costs and have fewer local emissions from motors without emission control technology. Any electrification strategy should include maintenance equipment replacements.

Strategy 3: Expand public access to electric vehicle charging infrastructure.

Most of Skokie's transportation emissions are from on-road vehicles. Recent federal and Illinois legislation provides an opportunity to expand public charging infrastructure. The Village has one Level II public charging station at Village Hall. Additional charging infrastructure for fleets and public use, placed in partnership with businesses such as shopping centers and cultural institutions, could provide needed charging infrastructure for the 1 million electric vehicle goal that the State of Illinois has targeted by 2030. Reducing fossil fuel use from vehicles will have an immediate effect, as source emissions from electric vehicles are nonexistent. Scope 2 emissions from electricity consumption will increase but will reduce substantially as more renewable energy is added to the electric grid. Additional reductions can be realized through solar photovoltaic installations to provide electricity to residential and commercial customers that can install them.

Residential

Residential emissions are a large source of Skokie's greenhouse gas footprint. Because it has an older housing stock, the Village should consider this to be a significant area of focus for potential improvement. There are four specific strategies targeted toward residential buildings in Skokie to consider.

Residential - Stationary Strategies

Strategy 1: Encourage Skokie citizens to take advantage of Nicor Gas and ComEd energy efficiency program incentives.

Both the Nicor Gas Energy Efficiency Program and the ComEd Energy Efficiency Program offer assessments, rebates, and educational opportunities for residential customers. The two initiatives that should be pursued are air sealing and attic insulation (commonly known as weatherization) and heating and cooling system upgrades.

Strategy 2: Encourage Skokie citizens to take advantage of renewed solar photovoltaic program incentives.

Recent State of Illinois energy legislation has provided the most cost-effective incentives for solar photovoltaic installations since solar programs started in Illinois over a decade ago. Residential customers with south facing roofs and 200A electrical services can relatively easily install a solar photovoltaic system to cover over 50 percent of their electrical consumption for a positive return on investment. ComEd provides a solar consumption calculator, and the Illinois Solar Energy Association provides lists of certified contractors to provide quotes to homeowners. Rental properties can also take advantage of solar benefits through either community solar programs or virtual metering options from owner-occupied multifamily units.

Strategy 3: Expand curb side composting in the Village.

Currently, Village residents can subscribe to curbside composting and have yard waste picked up seasonally. Removing organic material from the waste stream can reduce CO_2e emissions. Reducing 1lb of food waste eliminates approximately 4lbs of CO_2e emissions. An educational push to increase uptake would provide additional reductions from Scope 3 emissions.

Strategy 4: Electrify buildings where feasible.

As the electricity grid continues to see both voluntary and mandated renewable energy generation increases, an all-electric house becomes a lower emitting house. Electrification is currently feasible for older buildings, provided they have up to date 200A services with enough space in electrical panels to provide greater than 30A breakers to several appliances, including ranges, hot water heaters, and clothes dryers. Heat pump technology continues to evolve, allowing appliances to reduce electricity use by eliminating resistance-based heating. Coupled with solar photovoltaic installations, many homes, even older ones, can become truly zero emission homes.

An old building stock does require some safety considerations, including updating cloth and/or knob and tube wiring on circuits, updating grounding and aluminum contacts at the meter and panel, and potentially upgrading panels for a larger service or more room for expansion.

Residential – Mobile Strategies

Encourage residential households to adopt electric vehicles through charging station education. Encourage households to install home charging infrastructure through building permitting education, including any electrical panel upgrades, and fire and life safety considerations.

Commercial

Skokie is home to over 250 commercial businesses that also contribute significantly to emissions. Strategies for commercial buildings are similar to Village operations but are not controlled by the Village operations staff and require engagement.

Commercial - Stationary Strategies

Strategy 1: Require commercial properties to report their energy use intensity as part of an Energy Benchmarking ordinance.

Commercial properties can also use EnergyStar Portfolio Manager to track their energy use and begin to set reduction goals and targets. Voluntary programs can relate to a benchmarking ordinance and buildings that receive certification can be recognized by the Village. These ordinances are adopted in many large communities throughout the country.

Commercial - Mobile Strategies

Strategy 1: Encourage fleet electrification through public-private partnerships

Large commercial and industrial users in the Village that could reduce emissions through fleet electrification initiatives. Because mobile emissions are a large part of the Village's emissions, increasing fleet electrification and charging infrastructure can have a large effect on emissions.

Additional Emissions Reductions Not Covered by Municipal Inventories

Municipal greenhouse gas inventories cover Scope 1, Scope 2 and Scope 3 waste emissions for municipal operations, residential, commercial, industrial, and institutional land uses, for both mobile and stationary emissions. They do not cover Scope 1 fugitive emissions or Scope 3 supply chain emissions from the Village, businesses, or residences, but these emissions are considerable. The Village should consider working in partnership with businesses in the community to further reduce Skokie's footprint.

There are four main categories of activities that can reduce emissions:

1) **Purchasing:** Supply chain emissions are the largest emissions source. Concentrate on better purchasing options or reducing purchasing by encouraging reuse. Eliminate plastic and non-renewable products. The Village can encourage and promote reuse options and provide incentives to do so through reduced fees.
2) **Refrigerant Fugitive Emissions:** Inventory and maintain refrigerant containing equipment and retire equipment with high GWP refrigerants. As the lifetime of this equipment is long, it is important to have a plan for replacement before they fail. The Village should consider annual tracking of its refrigerant-containing equipment in its operations and commit to low-GWP refrigerant use in replacements.
3) **Non-Municipal Waste Emissions:** Increase composting and recycling efforts, and work with other Skokie businesses to repurpose waste streams into inputs where possible.
4) **Travel:** Non-automobile mobile emissions, especially airline travel, is a considerable emissions source that is not captured in a municipal inventory. Fortunately, these emissions are easy to track and offset. The Village can promote less GHG intensive

travel and encourage remote as opposed to in-person work arrangements.

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APPENDIX: METHODOLOGY

Stationary Emissions

Village Operations

Stationary emissions for Village operations were primarily calculated using electricity and natural gas usage reported for Village facilities by ComEd and Nicor, respectively. For electricity, consumption data was multiplied by the regional emissions factors provided by the U.S. Environmental Protection Agency's (EPA) Emissions & Generation Resource Integrated Database (eGRID) (U.S. Environmental Protection Agency, 2020). For natural gas, consumption was multiplied by the emissions factors as defined by EPA's GHG Emission Factors Hub (U.S. Environmental Protection Agency, 2018).

The Village also operates backup generators, whose diesel fuel consumption was reported by the Village. This diesel consumption was multiplied by the emissions factors as defined by EPA's GHG Emission Factors Hub (U.S. Environmental Protection Agency, 2018).

Community Operations

Residential electricity and natural gas usage was calculated using ComEd reported electricity data and publicly available information on residential natural gas consumption. For electricity, information on total usage in the zip codes covering Skokie was reported by ComEd (Commonwealth Edison, 2020). As information was for total usage, a percentage of the electricity usage was allocated to residential usage based on overall ComEd electricity sales by sector as reported by the U.S. Energy Information Administration (EIA) (U.S. Energy Information Administration, 2021). Residential electricity usage for Skokie residents was multiplied by the regional emissions factors provided by EPA's eGRID (U.S. Environmental Protection Agency, 2020). For natural gas, consumption information on residential usage was provided by Nicor (Nicor Gas, 2020). Consumption was multiplied by the emissions factors as defined by EPA's GHG Emission Factors Hub (U.S. Environmental Protection Agency, 2018).

Commercial electricity and natural gas usage was calculated using ComEd reported electricity data and publicly available information on commercial natural gas consumption. For electricity, information on total usage in the zip codes covering Skokie was reported by ComEd (Commercial Edison, 2020). As information was for total usage, a percentage of the electricity usage was allocated to commercial usage based on overall ComEd electricity sales by sector as reported by EIA (U.S. Energy Information Administration, 2021). Commercial electricity usage for Skokie residents was multiplied by the regional emissions factors provided by EPA's eGRID (U.S. Environmental Protection Agency, 2020). For natural gas, consumption information on commercial usage was provided by Nicor (Nicor Gas, 2020). Consumption was multiplied by the emissions factors as defined by EPA's GHG Emission Factors Hub (U.S. Environmental Protection Agency, 2018).

Manufacturing and industrial electricity usage was calculated using ComEd reported electricity data. For electricity, information on total usage in the zip codes covering Skokie was reported by ComEd (Commercial Edison, 2020). As information was for total usage, a percentage of the

electricity usage was allocated to manufacturing and industrial usage based on overall ComEd electricity sales by sector as reported by EIA (U.S. Energy Information Administration, 2021). Manufacturing and industrial electricity usage for Skokie was multiplied by the regional emissions factors provided by EPA's eGRID (U.S. Environmental Protection Agency, 2020). For natural gas, consumption information on manufacturing and industrial usage was provided by Nicor (Nicor Gas, 2020). Consumption was multiplied by the emissions factors as defined by EPA's GHG Emission Factors Hub (U.S. Environmental Protection Agency, 2018). No manufacturing facilities within Skokie responsible for reporting their individual emissions were reported through EPA's Facility Level Information on Greenhouse Gases Tool (FLIGHT) (U.S. Environmental Protection Agency, 2020).

The EPA's FLIGHT reports no energy industry facilities within Skokie (U.S. Environmental Protection Agency, 2020).

The EPA's FLIGHT reports no fugitive emissions associated with energy industry facilities within Skokie (U.S. Environmental Protection Agency, 2020).

Transportation Emissions

Village Operations

Gasoline and diesel consumption for the Village operated fleet was provided by the Village of Skokie. Consumption data was multiplied by the emissions factors as defined by EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks EPA's GHG Emission Factors Hub (U.S. Environmental Protection Agency, 2018).

Community Operations

On-road vehicle emissions were calculated using community specific VMT model data from the Chicago Metropolitan Agency for Planning (CMAP) multiplied against estimated annual average miles per gallon (MPG) consumption (Chicago Metropolitan Agency for Planning, 2022). Average MPG is calculated using annual US Department of Transportation Federal Highway Administration data including VMT share per vehicle classification and total fuel consumption per vehicle classification (Federal Highway Administration, 2020).

Rail emissions were calculated using the Federal Transit Administration's (FTA) data on fuel and energy for the Chicago Transit Administration (CTA) (Federal Transit Administration, 2019). A proportion of the CTA's electric propulsion consumption for the Yellow Line within Skokie was found by using CTA ridership data for the Oakton and Dempster Yellow Line Stations compared to total ridership (Chicago Transit Authority, n.d.). Electric propulsion data was then multiplied by the regional emissions factors from EPA's eGRID (U.S. Environmental Protection Agency, 2020).

No water or aviation operations occur within Skokie.

Waste Emissions

Village Operations

Solid waste emissions were calculated using waste volume data reported by the Village of Skokie for facilities. Data was converted to weight data using EPA's Volume-to-Weight Conversion Factors (U.S. Environmental Protection Agency, 2016). Using the methane commitment method, emissions for CH_4 were found using the emissions factors outlined in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories and the GHG for Cities Protocol (Greenhouse Gas Protocol, n.d.). Waste stream composition data was pulled from the 2015 Illinois Commodity/Waste Generation and Characterization Update (Illinois Recycling Association, 2015).

Community Operations

Solid waste emissions were calculated using data reported by the Village of Skokie for its municipal waste program. Using the methane commitment method, emissions for CH_4 were found using the emissions factors outlined in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories and the GHG for Cities Protocol (Greenhouse Gas Protocol, n.d.). The Village of Skokie reported for textiles and yard waste separately, which was used to calculate the fraction of these waste streams. For waste stream composition that was not available through the Village of Skokie reporting, data was pulled from the 2015 Illinois Commodity/Waste Generation and Characterization Update (Illinois Recycling Association, 2015).

Gallons of wastewater treated were reported by the Village of Skokie. This was multiplied by an emissions factor created using publicly available information on the Metropolitan Water Reclamation District's (MWRD) emissions and wastewater treated data (Metropolitan Water Reclamation District, 2021), (Metropolitan Water Reclamation District, n.d.).

Biological waste emissions were calculated using data reported by the Village of Skokie for its composting program. Emissions for CH_4 and N_2O were found using the emissions factors outlined in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories and the GHG for Cities Protocol (Greenhouse Gas Protocol, n.d.).