VILLAGE OF NORTHBROOK
ENVIRONMENTAL QUALITY COMMISSION

Thursday, June 17, 2021
Terrace Room – Second Floor
Village Hall – 1225 Cedar Lane

REGULAR MEETING AGENDA

7:00 P.M.

1) Call To Order
2) Review of Minutes – April 15, 2021 Meeting
3) Hear From the Audience – Items not on the agenda
4) Community Planning Report
5) GoGreen Leafblower Forum Summary
6) Northbrook Climate Action Plan Team Update
7) Updates on Other Items:
   a) Communication Initiatives & Messaging
   b) Solar Permit Data
   c) Village Plastic Bag Recycling Update
   d) Recycling & Waste Data – Solid Waste, Recycling, Compost, E-waste, Textiles
8) Old Business
9) New Business
10) Remarks for the Good of the Order
11) Next Scheduled Meeting – July 15, 2021
12) Adjourn.

The Village of Northbrook is subject to the requirements of the Americans with Disabilities Act of 1990. Individuals with disabilities who plan to attend this meeting and who require certain accommodations in order to allow them to observe and/or participate in this meeting, or who have questions regarding the accessibility of this meeting or the facilities, are requested to contact Greg Van Dahm or Debra J. Ford (847-664-4014 and 847-664-4013, respectively) promptly to allow the Village of Northbrook to make reasonable accommodations for those persons. Hearing impaired individuals may call the TDD number, 847-564-8465, for more information.

Jeremy Reynolds, Chair of the EQC

MEMORANDUM
VILLAGE OF NORTHBROOK
DEVELOPMENT AND PLANNING SERVICES DEPARTMENT

TO: ENVIRONMENTAL QUALITY COMMISSION

FROM: TESSA MURRAY, SUSTAINABILITY COORDINATOR

DATE: JUNE 17, 2021

SUBJECT: GOGREEN LEAF BLOWER WEBINAR SUMMARY

On April 9, 2021, GoGreen Wilmette held a virtual leaf blower forum with multiple organizations and communities in attendance to discuss how both public education and ordinances are important in creating cleaner and quieter communities.

The webinar first included panelists from the American Green Zone Alliance (AGZA) and Quiet Communities. AGZA provides certifications to municipalities and professional landscaping groups that complete training and investment in clean equipment. They mentioned Langton Group (based in Woodstock IL) as the only AGZA-certified professional in our state. Webinar participants mentioned the following landscapers in our region that use electric equipment: Chalet, Greenwise, and Sebert Landscaping.

Quiet Communities is a non-profit organization whose goal is to promote research and evidence-based education to spread awareness about this public health concern. They shared that gas engines emit predominantly low frequency noises, which can penetrate structures like windows and travel significant distance. The World Health Organization advocates for safety standards that consider this: "when noise includes a large proportion of low-frequency components, values even lower than the guideline [maximum sound level] values will be needed because low-frequency components in noise may increase the adverse effects considerably".

The next section of the forum included multiple municipalities speaking on their ordinances relating to leaf blower noise and activity. For a full list of participating communities, please see the database of ordinances in each community attached below this document. The presenter determined the most rigorous ordinance is in Kenilworth, banning all blower activity from May 15-September 30 and any equipment that exceeds 75 decibels (older models), including Village and Park District properties. State Senator Laura Fine spoke on the Senate Bill 3313 she introduced in early 2020, that would ban the use and sale of all gas-powered leaf blowers if passed in Illinois. The legislative session for SB3313 was adjourned without a date for reassignment in January 2021.

Some presenters raised concern of enforcement procedures that may place financial burden on small landscaping businesses, considering the cost of switching to electric equipment and fines associated with non-compliance. In consideration of environmental justice, Wilmette's ordinance provides an example in which the homeowner must be notified of the infraction, and the landscaping company itself is fined (rather than the operator). Some landscapers say they must raise the price to homeowners by at least 50% to afford upgrades. Webinar guests responded with ideas to incentivize electrics: lifting annual licensing fees, credit programs, or cost-sharing program. An example of this on the webinar included multiple homeowners within a neighborhood purchasing shared equipment for a landscaping crew to use throughout the participants' yards.

Communities	Ordinance? (Y = yes, N = no, U = unknown, P = pending)	Fine? (Y/N)	Fine amount?	Who is fined?	Notes	2021 Updates	2020 Updates
Barrington	None				Non-home rule community		
Buffalo Grove							
Deerfield							
Elmhurst	None						
Evanston	Noise + leaf blower ordinances	First violation letter, but if second offense	For second offense, fine is $100. Fines remain $100 each time no matter how often person offends	Person using leafblower - homeowner or worker	Prohibited May 16-Sept. 29 as well as after first Thursday in December until March 29. When allowed, M-F 7am-9pm and S/S/Holidays 9am-5pm		Back-mounted or handheld gasoline are not allowed. After September 30th - December first Thrusday they are allowed. March and May they are allowed. First time complaint, just a warning (depends on officer's discretion). The fines get higher and higher with each ticket. The company doing the service gets the ticket (she thinks, seemed unclear), but again up to officer's discretion.
Glen Ellyn	Only nuisance regulation	N/A	N/A	N/A	Restricts the use of tools for home and lawn maintenance to between the hours of 7:00 a.m. and sunset. Arguably, a leaf blower would fall under that regulation.	Notes section updated in 2021	
Glencoe	Noise + leaf blower ordinances	Yes - no first warning	$250 each time	Landscaping company	Gas-powered leaf blowers permitted between March 15-May 15 and Sept. 15 - Dec. 15.		No change from before - 250$ fine, dates are the same
Glenview	Noise ordinance	Yes - determined by police department	Determined by police department	Determined by police department	Noise ordinance exists.		Village code: 98374. Can only use during business hours. 847 724 1700 (resolution center). They can only write a legal notice if they see the violator in action. Noise ordinance.
Highland Park	Leaf blower ordinance	Yes	Between $200 and $500	Landscaper company	Only electric leaf blowers allowed between May 15 and October 1 on M-F between 7am-9pm and Saturday between 9am-5pm. No leaf blowers allowed on Sundays.	No changes. Ticketed on a complaint basis only.	No changes.

Kenilworth	Leaf blower ordinance				Village's ban on gasoline-powered leaf blowers from May 15 - September 30. The ban includes electric leaf blowers connected to portable gasoline-powered electric generators. Until that time, residents may continue using their leaf blower between 8:00 a.m. and 6:00 p.m., Monday - Friday, and between 9:00 a.m. and 5:00 p.m.on Saturdays. Leaf blowers, regardless of power source, may not exceed 75 decibels when in use.	Notes entered for what the ban is exactly (see Notes); their PD is NOT excluded; called on 4/8/21 for more information on fine amount/who is fined, waiting for return call	
Lake Bluff	Noise Ordinance	Yes	$25-$750	Contractor or company	M-F 8am-6pm; S/S/Holidays 9am-6pm.		Does allow gas powered leaf blowers during certain hours on certain days. If violated, then fined/cited for public nuisance. Fine same as before.
Lake Forest	Noise Ordinance	Yes	$10-$750 per offense	Determined by police department when citation is written - case by case basis	M-F 7:30am-7:30pm. Sat. 8:00am-5:30pm, Sun./Holidays 10am-5pm.		Are allowed to be used, but during times and dates in notes to left of this.

Lake Zurich	Noise Ordinance	N/A	N/A	N/A	N/A	All noise (other than ordinary vehicular noise) from operations of any use in the industrial districts shall comply with limitations on noise and noise pollution standards established by State of Illinois law. No mechanical, electrical, or other equipment that produces noise, electrical or magnetic interference, vibration, heat, glare, emissions, odor, or radiation outside the dwelling unit or any permitted accessory structure that is greater or more frequent than that typical of equipment used in connection with residential occupancy shall be used in connection with any home occupation. - There is no mention of leaf blowers specifically anywhere on their website nor in the ordinances.
Libertyville	Probably none					
Lincolnshire	Noise Ordinance only for contactors, not homeowners	Stop work order and potential fine - ONLY contractors will get fined, homeowners can use leafblowers whenever (outside of any noise ordinance times)	Up to $500	Homeowners never fined - contract companies may be fined depending on police decision	Permitted 7am-7pm M-F; 8am-6pm Sat.; no work Sunday or holidays.	Left VM on 9/8/20

Lincolnwood	Noise + usage ordinances	Speak to contractor + homeowner, give violation notice. Second offense = citation.	Judge gives fine; village suggests fine	Contractor definitely - but also perhaps homeowner (both have been cited for breaking construction ordinances in the past, just not leaf blowers)	When permitted, can be used between 7am-6pm M-F or 7am-12pm Saturday. Not permitted between May 15 and September 30		Left VM for Michael Brumm on 9/8/20
Morton Grove	Noise ordinance	N/A	N/A	N/A	Response from Gia: When we discussed this organizing opportunity/possible ordinance within our group there were lots of questions about enforcement. Who is enforcing these regulations/ordinances and who is targeted by these ordinances? When we discussed current regulations in other municipalities it seems those targeted with ticketing and violations/fines are those doing the work - not the home owner or business owner. This brings up sticky social justice issues for us and we have major concerns as a social justice group with the implications of such an ordinance on the workers getting the fines and situations. Likewise in Morton Grove the village staff is a very small group so it's likely the enforcement would fall to the police department. Our group actively advocates for downsizing the police budget and the relocation of funds to other services within a social justice framework, so adding additional tasks or getting the MG police involved would definitely be a major concern for our group members.	Beth asked Gia and Andrew on 3/30. Notes updated accordingly.	
Mount Prospect	Noise ordinance	Unclear	Unclear	Unclear	Unclear - the person I spoke with was not very willing to help		No ordinances

Northbrook	Noise ordinance	Yes, if person refuses to comply with citation	Up to $750/day/offense	The person holding the leaf blower	No specific ordinance for leaf blowers; the ordinance is for all power lawn equipment; the fining is rarely given at 750$, and this is subject to the assessment of the Hearing Officer	Updated 4/8/21	
Oak Park	Noise + leaf blower ordinances	Yes	Determined by judge	Homeowner if homeowner is operating; landscape company if worker is operating	The use of gas-powered leaf blowers emanating more than 65 decibels or failing to meet federal emission regulations is prohibited from June through October. The ban applies to both landscapers and homeowners. Gas-powered blowers that emanate fewer than 65 decibels and meet emission standards may be used during the ban if they have been tested and approved by the Village.		Same as before
Park Ridge	Noise ordinance	Yes, after warning	Determined by police	Unclear - case by case basis	Allowed on M-F 7am-7pm; Sat 8am-5pm		No specific ordinance for leaf blowers. Just noise.
Riverwoods	Noise ordinance	Yes	$75-$750	Person holding leafblower.	Allowed between M-F 7am-7pm; Saturday 8:30am-5pm		Verified by Laurie Breitkopf
Skokie	Noise ordinance	No	N/A	N/A	Can be used any day of the week between 9am-8pm. If someone using outside of that time frame, can call non-emergency police. No ticket guaranteed.		No ordinance, just noise. But the building head said it was "interesting" and understands why ordinances exist for environmental reasons.
Vernon Hills	Noise ordinance	Unclear	Unclear	Unclear	Allowed between M-F 7am-7pm; Saturday 8:30am-5pm		No ordinance besides noise.

Wilmette	Noise + leaf blower ordinances	First offence: 80$ to user and company owner Second offence and above: 160$ to user and company	Not determined by village	Person holding leafblower - homeowner or worker. If worker from landscaping company, then the company also gets charged.	Between May 15 and September 30, the Village of Wilmette prohibits the use of gasoline-powered leaf blowers. Between October 1 and May 14, the Village of Wilmette permits the use of gasoline-powered leaf blowers, however use of a gasoline-powered leaf blower during that time.		Tickets issued to BOTH person using the leafblower as well as the owner of the company (from Ted). GGW recommended to the Vilalge three changes to enforcement for 2021 season: No ticket for operator, just the company (becasue the low-wage worker is supplied with illegal equipment and told to use it by company); higher fines ($150 for frist ticket, $300 for subsequent violations); and homeowners should be notified with each offense and possibly fined for repeated offenses.
Winnetka	Noise + leaf blower ordinances	Yes	Increasing fine over mulitple offenses, but the police create the fines. At least $100.	Unclear - determined by police	Oct 1 - May 31, M-F 8-7; S/S 9-6. Can't use gas between June 1 and Sept 31		Left VM on 9/8/20

MEMORANDUM
VILLAGE OF NORTHBROOK
DEVELOPMENT AND PLANNING SERVICES DEPARTMENT

TO: ENVIRONMENTAL QUALITY COMMISSION

FROM: TESSA MURRAY, SUSTAINABILITY COORDINATOR

DATE: JUNE 17, 2021

SUBJECT: DRAFT CLIMATE ACTION PLAN

On June 17, 2021, the Environmental Quality Commission will consider the Draft Climate Action Plan (CAP), out for review via website link in an email sent to all Commissioners or on the Village Environmental Sustainability webpage (https://palebluedot.llc/northbrook-cap-review-menu). The CAP seeks to reduce our year 2010 carbon emission levels in Northbrook 35% by 2030 through a series of actions within sector categories. The goal of 35% reduction from baseline levels is in alignment with the Paris Agreement of 2015.

While Village staff is primarily initiating the CAP, implementation is intended for everyone; the plan cannot become reality without community members' participation. For each action item, the CAP identifies specific departments as responsibility-holders. When developing the CAP, team members recommended potential actors or partners for each action that would be instrumental in the item's success, often Commissions such as the EQC. For this reason, input from Commissioners on the CAP during this review period is crucial to identifying next steps in addressing climate change. The list of items below includes items that the CAPT recommended the EQC should consider taking a leadership or advocacy role in implementation.

The period for public comment on the webpage closes June 21, any feedback during this meeting will be considered as well.

Please note: Only actions where EQC is explicitly recommended as a partner are listed. Asterisked action items (**) indicate those in which the EQC has been identified as a leader for this goal. Each action item has its category initials, a strategy number, and an item number.

BE (Building Energy)

Strategy BE3: Educate public on solar and renewable energy

1. **BE3-1: Help showcase renewable energy at local fairs and events (Earth Day, etc). Work with education partners like Go Green, Library and schools at events like Earth Day.

Strategy BE6: Improve community-wide residential, commercial, and industrial building energy efficiency by 12% electricity and 10% natural gas by 2030.

2. **BE6-5: Through the EQC, ComEd, Nicor, and community partners like Go Green Northbrook, create a residential energy efficiency challenge. Establish annual targets for energy efficiency and a goal number of households to engage. Collect communication materials to share with residents. Develop a plan to drive residents to action. Identify other community groups that can build capacity for effective outreach and publicly recognize annual challenge "winners" with successful energy reduction achievements. Track annual progress and combine efforts with increased renewable energy purchases and installations.

Strategy BE8: Improve energy efficiency policy and incentives.

3. BE8-1: Create policies to support interior lighting upgrades to LED technology Village-wide. Promote and distribute education and information to residents and businesses on advantages of and options for LED technology. Explore options for focused buy-down programs for low-income residents, with graduated approaches for individuals and institutions able to better afford the up-front costs required to secure long-term savings. In addition to energy cost savings, maintenance costs are greatly reduced.

WM (Waste Management)

Strategy WM1: Decrease total per capita municipal solid waste handled by 5% by 2030.

4. WM1-1: Phase out single-use products by 2026 by implementing an opt-in fee for such products. This would apply to (but not limited to) bags (both paper and plastic), utensils, napkins, and take-out containers. Explore the feasibility of establishing a reusable takeout container service. Applies to businesses of any size. Encourage restaurants to allow customers to bring their own take-out containers.
5. WM1-3: Develop and then adopt an ordinance requiring reusables for dine-in restaurants and sustainable take-out food ware. This effort would reduce a significant source of single-use plastics and other high-carbon materials used in the Village.

Strategy WM2: Increase landfill waste diversion to 50% by 2030.

6. **WM2-1: Conduct a waste audit to determine waste diversion opportunities. Establish a Village Facility Zero Waste goal to eliminate landfill stream from office operations. Encourage other public agencies (schools, park district, library etc) and businesses.
7. WM2-2: Establish a zero waste Village Event policy making zero waste office operations and events standard.

Strategy WM3: Increase organics diversion from landfill.

8. **WM3-3: Establish a communication campaign to promote and increase the utilization of the curbside compost collection program to all residential properties (e.g., single-family and multifamily) for yard waste, food waste and certified compostable products.
9. WM3-4: Collaborate with residential and commercial organics haulers to establish organics diversion programs for residential and commercial buildings. Explore options such as trash Integrated Food Scrap Compost Collection (see Ramsey County MN pilot program https://cutt.ly/8vZ6lDc)
10. WM3-5: Combat food waste by encouraging retailers and restaurants to donate, reduce, reuse, or compost their unsold food, creating “zero-waste sections” where products are sold close to their expiration dates, and designating “zero-waste coaches” to raise awareness among staff and help manage products reaching the end of their marketable life. Edible unsold products shall be donated. When not edible, organic waste shall be composted through a Village-approved vendor.

Strategy WM5: Educate, engage, and empower the public to meet waste management goals.

11. WM5-2: Educate the community on waste management strategies. Introduce the term Zero Waste and lifecycle concepts. Include reducing consumption, followed by reusing, repurposing, recycling, and composting. Include clear information on what can and cannot be recycled. Offer tips such as opting out of junk mail, etc.
12. WM5-3: Support collaborative consumption community projects, such as neighborhood compost projects, tool libraries, and repair cafes through mini-grant programs.
13. WM5-4: Provide outreach and education to Village businesses in reducing greenhouse gas emissions through their supply chains
14. WM5-5: Encourage Northbrook residents to participate in organics collection through creation of “Include the Food” education campaign.

WW (Water and Wastewater)

Strategy WW1: Promote increased water conservation Village-wide with a targeted reduction of 7.5% by 2030.

15. WW1-1: Update Village wide landscaping guidelines for reducing water consumption and chemical use.

16. WM1-2: Reduce landscaping water use by encouraging water-efficient irrigation systems, grass replacement, and planting native and drought-resistant trees and vegetation.

Strategy WW2: Mitigate the projected increased flood hazards and impacts due to climate change.

17. WW2-1: Prioritize managing stormwater before it enters the sewer system through a combination of overland flow, detention, and infiltration strategies (i.e. permeable surfaces).
18. WM2-3: Adopt policies to incentivize building owners and developers to explore revegetation, tree preservation planting and maintenance, de-paving and porous pavement, green infrastructure like bioswales and Eco-roofs and site development performance standards.

LF: Local Food

Strategy LF1: Increase production of local food, particularly serving low income and food insecure individuals.

19. **LF1-2: Promote and expand public education campaigns to encourage purchasing and procuring locally grown and produced food at the individual and institutional level.
20. LF1-3: Promote local food production, sales, and consumption and review Village codes to remove barriers for urban farming including innovative solutions such as aquaponics, hydroponics, indoor agriculture, vertical farms.
21. LF1-6: Establish local agriculture ordinances clarifying the allowance of local food production activities such as front yard vegetable gardening, community gardens, urban farming, beekeeping, poultry keeping, etc.

Strategy LF2: Increase access to and interconnect all community gardening.

22. **LF2-1: Establish a communication system whereby local gardeners could trade food (i.e. if one person has too many tomatoes, could offer them to trade or for free pick up).
23. **LF2-4: Promote year-round farmers markets.

Strategy LF4: Improve local food resilience and availability.

24. LF4-3: Incentivize and reward soil best management practice for urban lawns, gardens, landscaping, parks, open spaces, prairies, environmentally sensitive areas, and agricultural land uses.

GS: Greenspace

Strategy GS4: Reduce heat island effect through Village-wide impervious surface reduction of 2% by 2030 and 5% by 2040.

25. GS4-8: Establish ordinances and/or incentives for developers to plant shade and water-absorbing trees and replace turf landscaping with native prairie, wild flower, and savanna plantings. Revise Sec. 25-34. "Ornamental and native grasses" of the Northbrook Municipal Code to include a "right to natural landscaping" clause to permit native natural grasses and landscapes.

CE: Climate Economy

Strategy CE1: Capture local economic potential of climate action.

26. CE1-1: Continue the Green Leadership Awards program to promote Northbrook as an environmentally friendly destination by highlighting the businesses that are taking steps to reduce resource consumption. Expand program to include environmental leadership among all community members.

Strategy CE4: Finance the Village's climate action implementation.

27. CE4-2: Establish a policy that designates Village Utility Franchise Fee Income as funding source for Climate Initiatives. Explore options for allocation of utility franchise fees for advancement of Village CAP goals prior to the next franchise fee agreement negotiation. (https://ilsr.org/energy/utility-franchise-fees/)
    ^EQC is listed here for researching similar programs, and making a recommendation to the Board.

Village of Northbrook

Climate Action Plan

FINAL DRAFT

April 27, 2021

Prepared by:

making change personal

paleBLUEdot LLC

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Northbrook's Future Climate

By 2050, Northbrook's climate can be expected to be:

+4-6°F
warmer average annual temperature than now.

+20-25 more days
annually with a high temperature over 95°F.

+70% more
air conditioning demand and energy needed than now.

+14% higher
annual average rainfall than now.

+15% more
Heavy precipitation events annually.

+20-25 days longer
growing, allergy, and mosquito season.

The time is right for Northbrook's first Climate Action Plan.

Executive Summary

The Village has a tradition of being a leader in addressing environmental issues and has become increasingly concerned about the global climate crisis. Over the course of the past decade, the Village has been refining its local policies to address environmental issues. In 2013, the Village and Northbrook Park District partnered to create the Strategic Sustainability Plan, which outlines improvements and initiatives in energy, material management, natural resources, community development and transportation for a more sustainable future. Five years later, the Village adopted a Master Bicycle and Pedestrian Plan which has been used to promote alternate means of transportation throughout the community

In September 2018, the Village signed on to the Metropolitan Mayors Caucus' Greenest Region Compact. The goals of the Compact address ten areas, including climate, economic development, energy, land, leadership, mobility, municipal operations, sustainable communities, water, and waste & recycling. These goals help guide coordinated efforts across the region to enhance quality of life for residents, protection and stewardship of the environment, and sustainable economic vitality.

As a continuation of the Village's sustainability efforts over the last decade, Northbrook has a vision to minimize the generation of GHG emissions from all sources and prepare for climate change. This Climate Action Plan establishes a comprehensive plan of specific strategies and detailed actions that Northbrook looks to implement to reduce greenhouse gas emissions and build resilience to related climatic impacts.

Our Challenge

The complex systems that make up modern civilization result in stressors on the delicate balance of our ecosystems. The combustion of fossil fuels is warming earth's atmosphere and changing our climate. Climate change is already affecting Northbrook and its impacts are projected to become much more severe in the coming decades. These impacts also contribute to additional strain on vulnerable populations, social systems, and overall community resilience.

Our Opportunity

The impacts of cities represent a major sustainable development opportunity. Transformation of our energy system is essential in order to stop burning fossil fuels. This transition presents an opportunity for Northbrook. Directing our energy investments into renewable sources will make them more resilient and provide for local job creation. Innovation, technology, and collective social change inherent in climate action can also support greater community abundance and shared equity.

Our Climate Action Vision

To be the first Climate Resilient community in Illinois, leading in the social and economic transitions necessary to reduce Villagewide greenhouse gas emissions in-line with the Paris Climate Agreement while protecting Northbrook's natural ecosystems, most vulnerable populations, and economic vitality against the increasing impacts of climate change.

The Process

The work that went into developing the Northbrook Climate Action Plan

12 month
planning timeframe

31
planning team members

418
community members providing input

5
foundational research study documents

Executive Summary

GHG Emission Reduction Goal in Global Context

Reviewing the Village's Climate Action Plan emissions reduction goal within a global context and greenhouse gas emissions (GHG) reduction recommendations formulated by the International Panel on Climate Change (IPCC) can help validate the appropriateness of the goal. The IPCC is the United Nation Environment Programme (UNEP) body for assessing the science related to climate change and providing support in climate action policy making. IPCC science has guided a number of international agreements to address climate change, most recently the Paris Agreement.

The Paris Agreement is a landmark international accord that was adopted by nearly every nation in 2015 to address climate change and its negative impacts. The agreement affirms IPCC recommendations by aiming to limit global warming to 1.5°C to 2°C above pre-industrial levels, considered to be the threshold for dangerous climate impacts. The agreement includes commitments from all major emitting countries to cut their climate pollution and to strengthen those commitments over time.

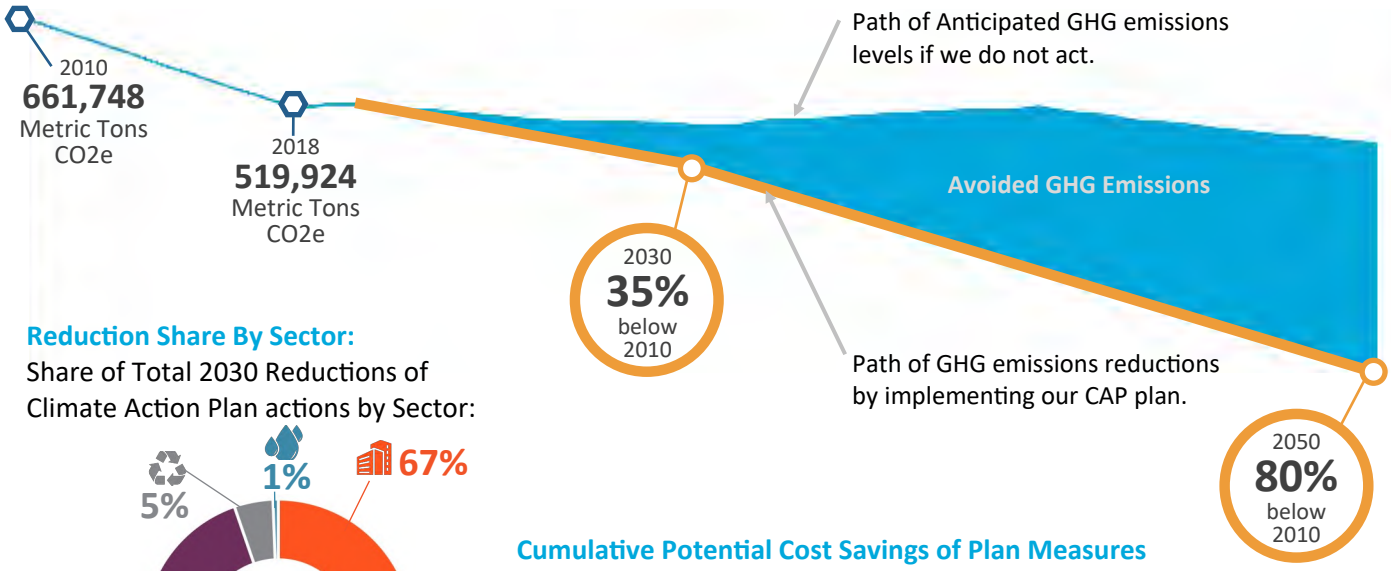
In alliance with the Paris Agreement, the United States committed to cut emissions by 26% to 28% by 2025 against a 2005 baseline. In 2019, the State of Illinois entered the Paris Agreement and also pledged to reduce emissions by 26% to 28% by 2025.

Our Carbon Reduction Goal

This plan seeks to re-affirm the Village's commitment to the Metropolitan Mayors Caucus' Greenest Region Compact and support the State of Illinois' emissions reductions goals. To do so, the plan must align itself within the IPCC suggested carbon emission reduction goals associated with the Paris Agreement of 26%-28% reduction by 2025 and 80% or greater reductions by 2050. These global recommendations and State and National commitments were accounted for in the formulation of appropriate carbon reduction goals for Northbrook:

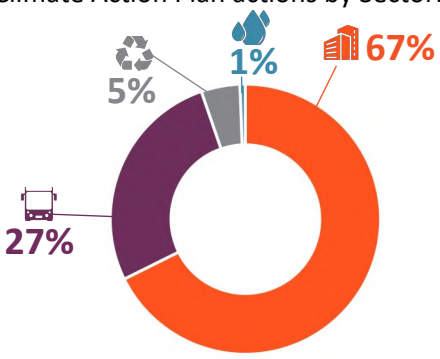
The Village of Northbrook's GHG emission reduction goals are to be compatible with the 2015 Paris Agreement and shall target a reduction in Village operations and community-wide emissions of 35% below 2010 levels by 2030 and 80% below 2010 levels by 2050.

Northbrook's Carbon Reduction Pathway:



Reduction Share By Sector:

Share of Total 2030 Reductions of Climate Action Plan actions by Sector:



Cumulative Potential Cost Savings of Plan Measures Through 2030:

$180,000,000

Implementing many of the measures in this plan, such as reduction of energy consumption can save money for the community.
(see Appendix for more)

Executive Summary

Climate Action Plan as Living Plan

This Climate Action Plan is intended as a "living plan" rather than a static document. This means that the implementation phase of this plan should be characterized by intermittent measurement of progress and plan adjustments. Plan adjustments should look towards increasing implementation goals for actions which illustrate success, modify goals for actions which may fall short of desired outcomes, and identifying additional action opportunities.

As a "living plan," the 2030 emission reduction goal should be seen as a guiding constant and recognition should be given that initial implementation actions may not yet fully achieve plan goals. Intermittent plan progress measurements and adjustments should identify additional actions, or increases in action implementation targets as needed to meet the ultimate 2030 GHG reduction goal.

The Plan

The Northbrook Climate Action Plan:

addresses **8 sectors** of GHG emissions and climate vulnerabilities

through **42 strategies** of GHG emissions and climate vulnerabilities

supported by **190 actions** detailing steps to be taken

during a **10 year** implementation timeframe

Section 02 **Transportation and Land Use**

Strategy TL 1: Decrease vehicle miles traveled (VMT) by 2.5% by 2030.

Strategy TL 2: Increase public transit ridership from 11.8% to 14% by 2030

Strategy TL 3: Increase walk/bike transportation by 50% and expand discretionary walk/bike infrastructure by 2030

Strategy TL 4: Transition Village fleet to alternative fuels, achieving 50% electrification of the Village's Vehicle and Equipment fleet by 2030.

Strategy TL 5: Support and encourage alternative fuel vehicles, achieve 20% of vehicles sold and 15% reduction of VMT by 2030.

Strategy TL 6: Advance low-carbon land use policy.

Strategy TL 7: Reduce Village wide off-road and lawn equipment annual emissions.

Section 03 **Buildings and Energy**

Strategy BE 1: Increase on-site distributed renewable energy to 10% of Residential and Commercial electric use by 2030.

Strategy BE 2: Improve Renewable Energy Policy and Incentives.

Strategy BE 3: Educate public on solar and renewable energy.

Strategy BE 4: Increase Residential and Commercial green electricity purchasing Village Wide to 5% by 2030.

Strategy BE 5: Improve total Village owned building and operations energy efficiency by 12% Electricity and 10% Natural Gas by 2030.

Strategy BE 6: Improve total Community wide residential, commercial, and industrial building energy efficiency by 12% Electricity and 10% Natural Gas by 2030.

Strategy BE 7: Achieve 2% natural gas "fuel switching" in community wide residential, commercial, and industrial buildings to reduce on-site fossil fuel use by 2030.

Strategy BE 8: Improve Energy Efficiency Policy and Incentives.

Strategy BE 9: Educate public on energy efficiency.

Executive Summary

Our Climate Action Strategies

Section 04 **Waste Management**

Strategy WM 1: Decrease total per capita municipal solid waste handled by 5% by 2030.

Strategy WM 2: Increase landfill waste diversion to 50% by 2030.

Strategy WM 3: Increase organics diversion from landfill.

Strategy WM 4: Increase recycling rate.

Strategy WM 5: Educate, engage, and empower the public to meet waste management goals.

Section 05 **Water and Wastewater**

Strategy WW 1: Promote increased water conservation Village Wide with a targeted reduction of 7.5% by 2030.

Strategy WW 2: Mitigate the projected increased flood hazards and impacts due to climate change.

Strategy WW 3: Update design standards and plans to meet projected climate change flood mitigation requirements.

Strategy WW 4: Increase stream, river and wetland protection and restoration.

Section 06 **Local Food and Agriculture**

Strategy LF 1: Increase production of local food, particularly serving low income and food insecure individuals.

Strategy LF 2: Increase access and interconnect all community gardening.

Strategy LF 3: Reduce food waste and hunger.

Strategy LF 4: Improve local food resilience and availability.

Section 07 **Health and Safety**

Strategy HS 1: Establish and expand public health communication campaigns to include climate change impacts.

Strategy HS 2: Assist the village's heat, flooding, storm, and poor air quality vulnerable population in preparing for and mitigating climate change impacts.

Strategy HS 3: Include climate impacts and health risks in new and updates to existing plans and policies.

Strategy HS 4: Strengthen community response capacity and support networks.

Strategy HS 5: Address the air quality risks associated with climate change.

Section 08 **Greenspace and Ecosystem**

Strategy GS 1: Increase Tree Cover and Diversity.

Strategy GS 2: Increase the resilience and use of Native Species and Pollinator Restorations Areas with a targeted increase of 1.5% communitywide land pollinator restoration coverage.

Strategy GS 3: Reduce, repurpose, and reimagine lawn space.

Strategy GS 4: Reduce Heat Island Effect through Village Wide impervious surface reduction of 2% by 2030 and 5% by 2040.

Section 09 **Climate Economy**

Strategy CE 1: Capture local economic potential of climate action.

Strategy CE 2: Increase workforce development for the climate economy.

Strategy CE 3: Build marketplace climate resilience.

Strategy CE 4: Financing The Village's climate action implementation.

Next Steps and Implementation

This Northbrook Climate Action Plan is only the beginning of an on-going process of evaluating and advancing the Village's climate resilience, GHG emissions, and overall sustainability. The plan includes a Climate Action Implementation section providing a framework for launching, guiding, monitoring, and evaluating the execution of this plan. The implementation section outlines specific next steps, and important implementation considerations and recommendations. As details and outcomes are uncovered during the implementation phase, adjustments to quantitative goals, milestones, and detailed actions will be made responsively.

Executive Summary

Next Steps and Implementation

This Northbrook Climate Action Plan is only the beginning of an on-going process of evaluating and advancing the Village's climate resilience, GHG emissions, and overall sustainability. The plan includes a Climate Action Implementation section providing a framework for launching, guiding, monitoring, and evaluating the execution of this plan. The implementation section outlines specific next steps, and important implementation considerations and recommendations. As details and outcomes are uncovered during the implementation phase, adjustments to quantitative goals, milestones, and detailed actions will be made responsively.

Acknowledgements

We are deeply grateful for the community collaboration and input that went into this plan. Below are some of the main contributors that made Northbrook's first CAP possible:

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Scott Robson	Northbrook EQC Commission
Joan Scovic	Northbrook Park District
Aaron Stash	Northbrook Resident
Patti Vile	Community Relations Commission
Sandy Weiss	Northbrook Environmental Quality Commission

GHG Emissions

generated community-wide in Northbrook

76,720
Metric tons CO2e in 2018 from vehicle use.

419,723
Metric tons CO2e in 2018 from building energy.

21,246
Metric tons CO2e in 2018 from solid waste

2,234
Metric tons CO2e in 2018 from water and wastewater

Section 01
Introduction

Click here to return to TOC

Introduction

Northbrook is a dynamic community of 33,170 residents and a diverse economic base located in the northern section of Cook County, Illinois. The Village supports a significant employee base with over 38,000 individuals working in the community which is home to the corporate headquarters of Underwriters Laboratories, Crate & Barrel and more than 700 manufacturing, light industrial and service-related businesses.

The Village has a tradition of being a leader in addressing environmental issues and has become increasingly concerned about the global climate crisis. In 2013, the Village and Northbrook Park District partnered to create the Strategic Sustainability Plan, and in September 2018, the Village signed on to the Metropolitan Mayors Caucus' Greenest Region Compact. The goals of the Compact address ten areas, including climate, economic development, energy, land, leadership, mobility, municipal operations, sustainable communities, water, and waste & recycling.

In May 2020 the Village hired paleBLUEdot to develop a Climate Action Plan. The goal of the project was to inventory Northbrook's community-wide greenhouse gas emissions, assess the village's forecasted climate change impacts, exposure, and sensitivity, and to establish and prioritize climate action and mitigation actions

In support of establishing the goals, strategies, and actions included in this plan, paleBLUEdot also produced a Greenhouse Gas Inventory, a Climate Vulnerability Assessment, a village wide Solar Renewable Energy Potentials Study, a community wide Tree Survey and Carbon Sequestration Study, and a village wide Climate Action Baseline Assessment. These assessments created the foundation of the Climate Action Planning process.

Plan Document Support of Northbrook Plans

This Climate Action Plan leverages, supports, and expands on the Village's other recent planning efforts. The strategies and actions included in this report relate closely to the foundational work already completed by the Village, including the 2013 Strategic Sustainability Plan as well as the 2018 Master Bicycle and Pedestrian Plan.

Why Create a Climate Action Plan

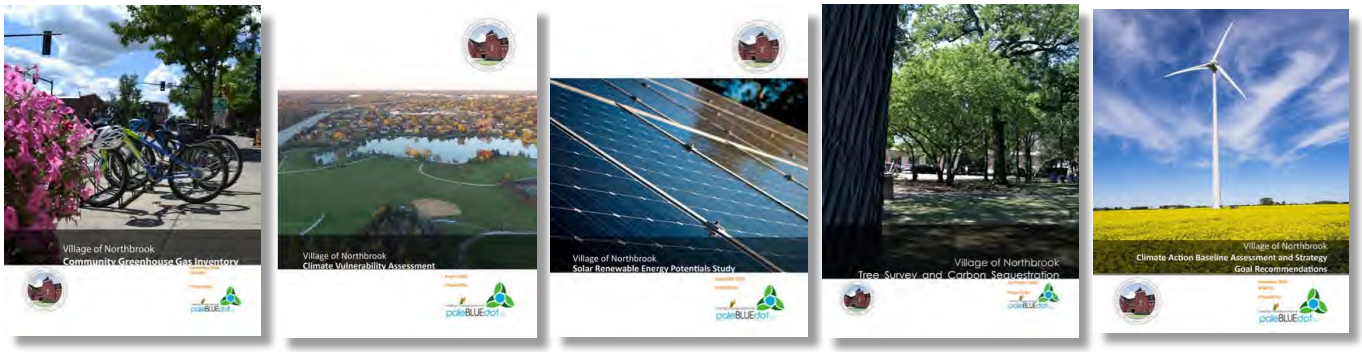
The creation and dedicated implementation of a Climate Action Plan (CAP) is an organized way for a Village to contribute to solving the global climate crisis while helping its resident and business communities create improved resilience to the current and future impacts and risks of climate change. Climate action can also create investment in innovation, jobs and actions that save households and businesses money.

What is a Climate Action Plan (CAP)

Climate action plans are comprehensive road maps that outline the specific Strategies and Actions that a Village will implement to reduce greenhouse gas emissions and build resilience to related climatic impacts. The Northbrook CAP addresses both climate mitigation and climate adaptation actions.

The Role of Cities in Climate Action

With a large majority of Americans living in urban areas, cities play a key role in addressing climate change. While each individual community's impact on global GHG emissions is relatively small, the leadership cities provide in motivating change can be extremely significant. According to a survey by the US Conference of Mayors, more than half (53%) had committed to reducing greenhouse gas emissions.



Introduction

Climate Action as a Journey

The Climate Action Plan represents a robust vision of the future with a comprehensive scope of actions befitting the magnitude of our collective climate challenge ahead. This Climate Action Plan establishes a long-term climate resilience vision and mitigation goal for the community through 2050. The plan itself, its strategies, and detailed actions, are intended as a 10 year plan. It is anticipated that this plan would be updated by 2030 to outline the next phase of action towards achieving the long-term community-wide goals.

The Northbrook Climate Action Plan should be seen as a living document. Action progress and effectiveness should be reviewed at regular intervals through the plan's implementation and adjustments should be made to expand or modify the scope of individual actions and to augment the plan with new actions as appropriate to respond to ever-changing market and community conditions.

Benefits of Climate Action

The strategies and actions contained in this plan seek to reduce Northbrook's dependence on fossil fuels, prioritize sustainable uses of land and water, reduce waste, and support improved equity and livability. The actions outlined in this plan will reduce Northbrook's GHG emissions. In addition to reducing the community's contribution to climate change this plan strives to identify how climate change will increasingly impact the community. The Climate Action Plan addresses next steps for Northbrook to adequately respond to climate change. If implemented successfully the plan will enhance Northbrook's economic vitality, resilience, and viability as a healthy, livable community.

Introduction

Northbrook's Vulnerability to Climate Risks:

Climate change is a global phenomenon that creates local impacts. It presents one of the most profound challenges of our time. A broad international consensus exists among atmospheric scientists that the Earth's climate system is being destabilized in response to elevated levels of greenhouse gas emissions in the atmosphere.

Two changes to Illinois's climate are occurring already: shorter winters with fewer cold extremes, and more heavy and extreme precipitation. Increases in the global surface temperature and changes in precipitation levels and patterns are expected to continue and intensify for decades. In turn, these changes in climate have impacts on the economy and health of local communities.

The following highlight the vulnerabilities to climate risks facing Northbrook, excerpted from the 2020 Northbrook Climate Vulnerability Assessment:

Heat Stress
(High)

Warmer temperatures and more extreme heat may lead to higher risk of heat-related illness.

Air Quality
(High)

Increased heat may result in more days of poor air quality and exposure to allergens, impacting respiratory illnesses.

Vector-Borne Disease
(Medium)

Longer growing seasons and higher temperatures may increase vector-borne diseases like West Nile Virus and Lyme disease.

Mental Health
(Medium)

Exposure to increased climate impacts and disasters may lead to increased anxiety and other mental health ramifications.

Housing
(High)

Warmer temperatures will increase demand for air conditioning and weatherization needs. Energy costs may be difficult for vulnerable populations to meet. Heavier rains coupled with higher risk of surface drought conditions may cause more local flooding, particularly "flash flooding" which could cause damage to housing and reduce mobility for portions of the community.

Stormwater Management
(High)

Heavier rains coupled with higher risk of surface drought conditions may significantly increase demand on stormwater management. The village's stormwater infrastructure may not be capable of handling the amount of runoff during more frequent heavy down pours, requiring resources to make needed upgrades.

Trees, Greenspace, and Agriculture
(High)

Increased temperatures and changes to precipitation will stress trees, greenspace, and agriculture. Conditions may be more favorable for disease, pests, and invasive species. Trees and crop species which formerly thrived in the area's climate may be less suited for future climate conditions.

Surface Water Quality
(Low)

Increases to heavy rain events and flooding/flash flooding risk may negatively impact water quality in the village's lakes, streams, and rivers. Increased pollutants and contamination potential, combined with increased annual water temperatures could increase risk to algal and bacterial growth, harming habitats and limiting recreation.

Introduction

Estimated Economic Risk of Climate Change to Northbrook by 2100

Incidents of severe weather in the United States, such as significant flooding in the Midwest are tangible examples of the types of economic impacts of projected climate trends. Future economic and social impacts of climate change include impacts to agriculture, energy costs, labor impacts, death rates, and crime impacts among others. "Estimating Economic Damage from Climate Change in the United States," a study by Solomon Hsiang et al from the Goldman School of Public Policy at the University of California Berkeley, was a comprehensive effort at quantifying the economic impacts for every county within the United States.
(https://science.sciencemag.org/content/356/6345/1362)

The study collected national data documenting the responses in six economic sectors to short-term weather fluctuations. These data were integrated with probabilistic distributions from a set of global climate models and used to estimate future costs during the remainder of this century across a range of scenarios. In terms of overall effects on gross domestic product, the authors predict negative impacts in the southern United States and positive impacts in some parts of the Pacific Northwest and New England.

The sectors assessed, and the findings for annual economic impact as a percentage of GDP for the Village of Northbrook based on a pro rata share of Cook County estimates are:

Agriculture	Energy	Productivity	Property Crime	Violent Crime
-27.8%	+10.5%	-1.25%	+1.5%	+3.72%

$51,189,564
Annual Cost Impact (in 2020 dollars)*

* Figure does not include increased healthcare costs due to increased illness and disease, nor increased property damage due to increased extreme weather events.

Estimated Social Cost of Carbon

"Social Cost of Carbon" is an effort to properly account for the damages caused by greenhouse gas emissions and the resulting climate change impacts. By including the social cost of carbon in planning efforts, agencies and business can properly evaluate policies and decisions that affect greenhouse gas emissions. The "Social Cost of Carbon" is measure of the share of climate change economic harm and impacts from emitting one ton of carbon dioxide into the atmosphere. For Northbrook it can be calculated as follows:

Estimated Economic Risk of Climate Change:		Current Annual GHG Emissions:		Current Estimated Localized Social Cost of Carbon:
$51,000,000 Annual Cost Impact	÷	**519,924** Metric Tons	=	**$99** Per Ton

Cumulative Economic Savings Potential of Implementing the Climate Action Plan Through 2030

Transportation Savings Potential:		Energy Efficiency and Renewable Energy Savings Potential:		Waste Reduction Savings:		Social Cost of Avoided Carbon:
$43,000,000	+	$45,000,000	+	$44,000,000	+	$43,000,000

Cumulative Community-Wide Savings Potential:
= **$175,000,000***

* Value does not include economic potential of job creation and new business potential represented in the Climate Action Plan actions. (see Appendix for more)

Introduction

What Are GHG's?

A greenhouse gas is a molecule in the atmosphere which does not react to light energy in the visible range (like sunlight), but does react to light energy in the infrared range -like that which is emitted from the Earth after being warmed by the sun. The most common greenhouse gases include carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O).

Why do GHG's Matter?

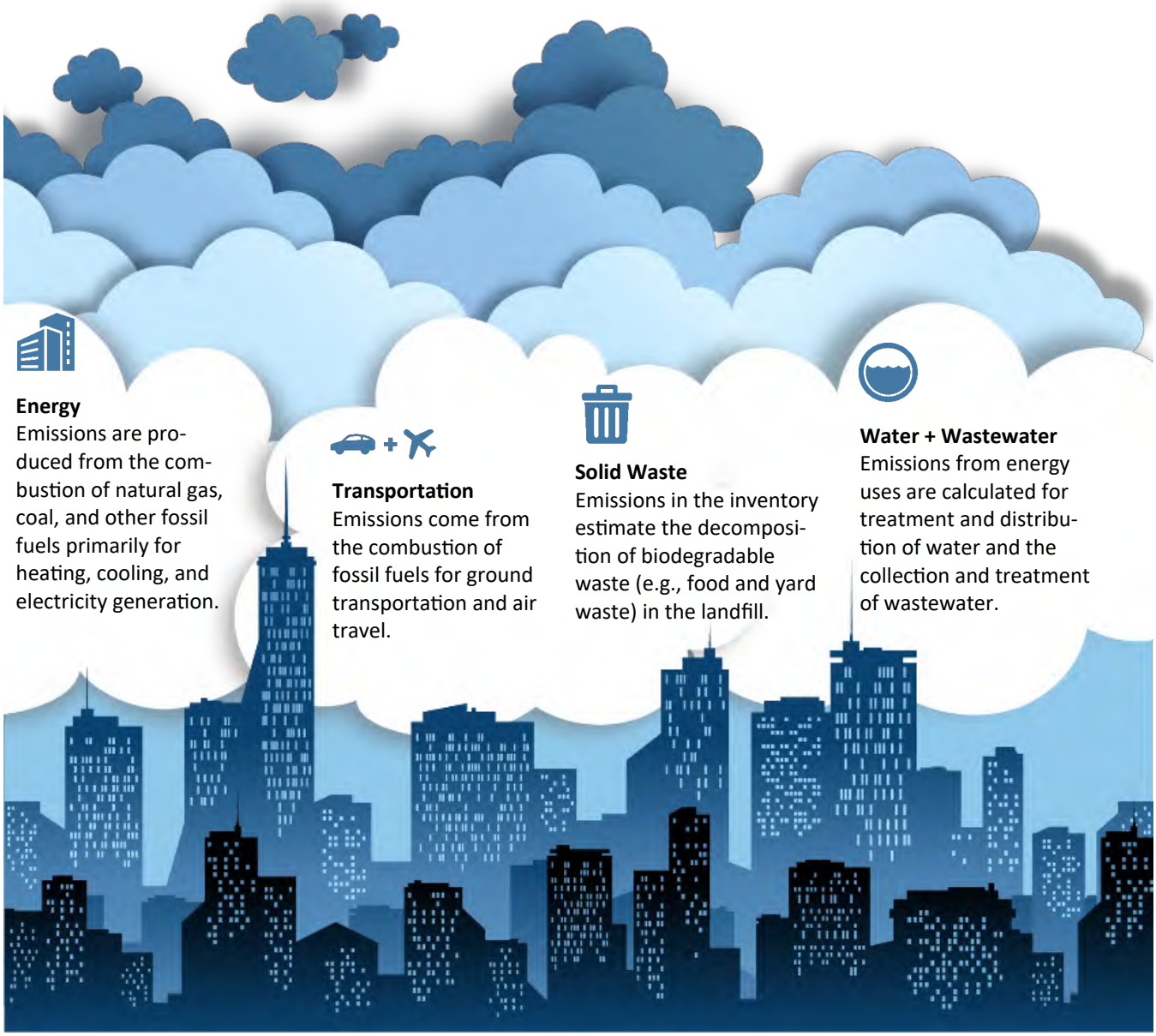
GHG's let the sun's light shine onto the Earth's surface, but they trap the heat that reflects back up into the atmosphere. In this way, they act like the insulating glass walls of a greenhouse. The more GHGs there are, the more heat that is trapped in our atmosphere and the more we experience the impacts of global warming.

What can we do to reduce GHG's?

Greenhouse gases can be reduced by making changes within the key greenhouse gas sectors within our community—particularly through the reduction and elimination of fossil fuel combustion and the advancement of clean energy sources.

Key Greenhouse Gas Sectors

Where do villagewide GHGs come from?



Northbrook Community Wide GHG Emissions Trends

2010 By The Numbers

GHG Emissions
661,748
19.91 MT Per-Capita
17.94 MT / Job
0.3205 MT / $1,000 GDP

Population
33,240

GDP
$2,064,691,936
$62,115 GDP Per-Capita

Employment
36,882

2018 By The Numbers

GHG Emissions
519,924
15.68 MT Per-Capita
13.64 MT / Job
0.2220 MT / $1,000 GDP

Population
33,167

GDP
$2,342,220,088
$70,619 GDP Per-Capita

Employment
38,120

8 Year Trend Dashboard

GHG Emissions
-141,824 -21.43%
-4.23 MT Per-Capita
-4.30 MT / Job
-0.10 MT / $1,000 GDP

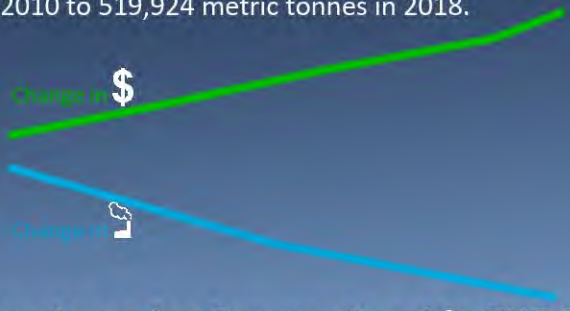
Population
-73 -0.22%

GDP
+$277,528,153 +13.44%
+$8,504 GDP Per-Capita

Employment
+1,238 +3.36%

Northbrook Community Wide GHG Emissions Overview

Community wide total emissions for the Village of Northbrook dropped 21.43% from 661,748 metric tonnes in 2010 to 519,924 metric tonnes in 2018.

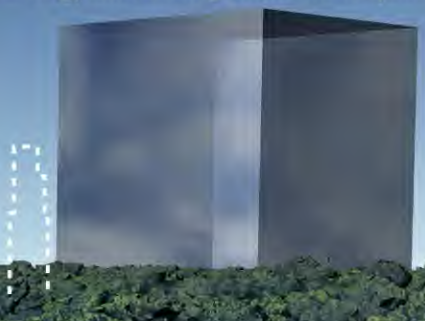


Think Economic Development is Tied To Increased Emissions?

Think again! Between 2010 and 2018 the Village was able to decrease it's GHG emissions by 21.43% while growing it's economy by 13.44% (pro rata share of County reporting) and adding 3.36% more jobs!

How Large Are Community wide GHG Emissions?

The community's total emissions for 2018 are equal to **10.2 Billion** cubic feet of man-made greenhouse gas. This volume of atmosphere is equal to a cube **2,168** feet on each face, seen here from Rosewood Beach more than 5 miles away.



Volume comparison to the Willis Tower, Chicago.

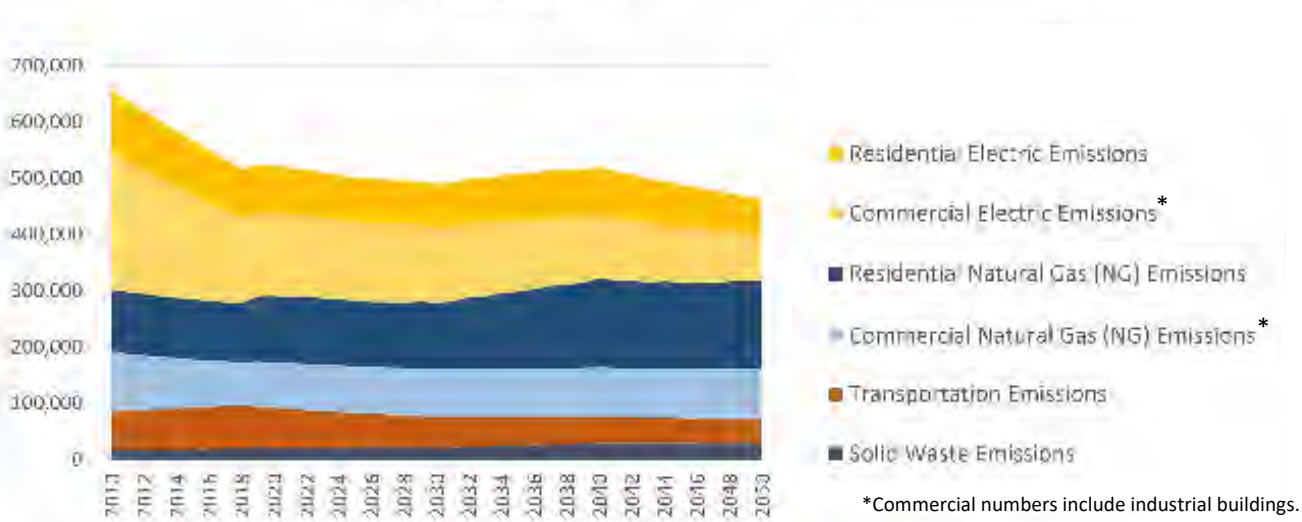
Community Wide GHG Emissions By Sector

Introduction

Villagewide GHG Emissions Forecast

A GHG emission forecast supports GHG reduction planning efforts by anticipating what emissions may be like if actions are not taken. Emissions are typically forecast under a business-as-usual (BAU) scenario. The Intergovernmental Panel on Climate Change (IPCC) defines a "business-as-usual" baseline case as the level of emissions that would result if future development trends follow those of the past and no changes in policies take place.

The Village of Northbrook GHG forecasts included here were based on population, employment, and vehicle use growth estimates determined by 10 and 20 year historic growth rates and by the Chicago Metropolitan Agency for Planning. In addition to these data, the BAU draws from information from the US Environmental Protection Agency, US Department of Transportation, and US Energy Information Agency. The full assumptions used for the Business-as-usual GHG Emissions Forecast model are outlined in detail in the appendix of this plan.



*Commercial numbers include industrial buildings.

Change from 2010	2030 GHG Emissions	-25.5%
	Total Annual GHG	491,924
	Goal Annual GHG	429,188
	Difference	62,737
	Electricity Use Emissions:	-40.8%
	Residential	75,178
	Commercial	135,627
	Natural Gas Use Emissions:	-6.4%
	Residential	117,427
	Commercial	86,558
	Transportation Emissions:	-19.0%
	VMT (Thousands)	167,719
	Solid Waste Emissions:	21.3%
	LFG Emissions	21,598
	Wastewater+Water :	1.2%
	Wastewater Emissions	955
	Water Emissions	1,309

Change from 2010	2040 GHG Emissions	-20.8%
	Total Annual GHG	522,809
	Goal Annual GHG	407,417
	Difference	115,391
	Electricity Use Emissions:	-44.0%
	Residential	85,003
	Commercial	113,461
	Natural Gas Use Emissions:	13.6%
	Residential	158,361
	Commercial	89,331
	Transportation Emissions:	-31.8%
	VMT (Thousands)	168,404
	Solid Waste Emissions:	65.3%
	LFG Emissions	29,320
	Wastewater+Water :	33.4%
	Wastewater Emissions	1,303
	Water Emissions	1,786

Change from 2010	2050 GHG Emissions	-29.5%
	Total Annual GHG	455,829
	Goal Annual GHG	105,646
	Difference	350,183
	Electricity Use Emissions:	-59.1%
	Residential	52,283
	Commercial	82,559
	Natural Gas Use Emissions:	1.1%
	Residential	158,054
	Commercial	90,682
	Transportation Emissions:	-38.5%
	VMT (Thousands)	171,835
	Solid Waste Emissions:	66.2%
	LFG Emissions	29,495
	Wastewater+Water :	21.4%
	Wastewater Emissions	1,308
	Water Emissions	1,793

Introduction

Our Carbon Reduction Goal

This plan seeks to re-affirm the Village's commitment to the Metropolitan Mayors Caucus' Greenest Region Compact and support the State of Illinois' emissions reductions goals. To do so, the plan must align itself within the IPCC suggested carbon emission reduction goals associated with the Paris Agreement of 26%-28% reduction by 2025 and 80% or greater reductions by 2050. These global recommendations and State and National commitments were accounted for in the formulation of appropriate carbon reduction goals for Northbrook:

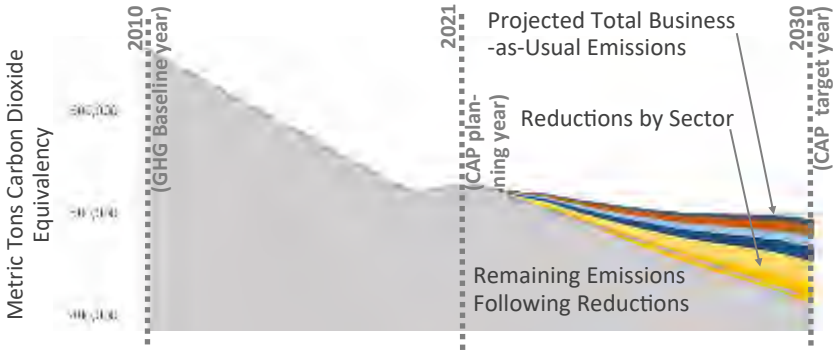
The Village of Northbrook's GHG emission reduction goals are to be compatible with the 2015 Paris Agreement and shall target a reduction in Village operations and community-wide emissions of 35% below 2010 levels by 2030 and 80% below 2010 levels by 2050.

This community-wide goal is reflected in strategies established for individual sectors which seek to both support the Village's Climate Action Plan in creating a climate resilient community and to reduce villagewide GHG emissions in line with the above goal. Sector goals related to GHG emissions reductions are designed to balance reduction across all sectors and achieve the overall emissions goals set forth for the community. The goals seek to strike a balance between achievability while also reaching for improvement beyond business-as-usual.

Estimated Villagewide GHG Reductions Included in This Plan

Long-term emission reduction potentials of the strategies and actions included in this plan have been modeled based on projected energy and fuel reductions and adoption rates of renewable energy and low/no emission transportation modes outlined in the strategies and actions. From this modeling, we know that with the successful implementation of this climate action plan, villagewide annual GHG emissions are projected to be 244,706 metric tons below 2010 levels and 104,341 metric tons below 2018 levels. The potential cumulative GHG emissions reductions over the 10 year implementation period are estimated at over 432,810 metric tons - an elimination of over **8.5 billion cubic feet** of man made greenhouse gas atmosphere resulting from this climate action plan.

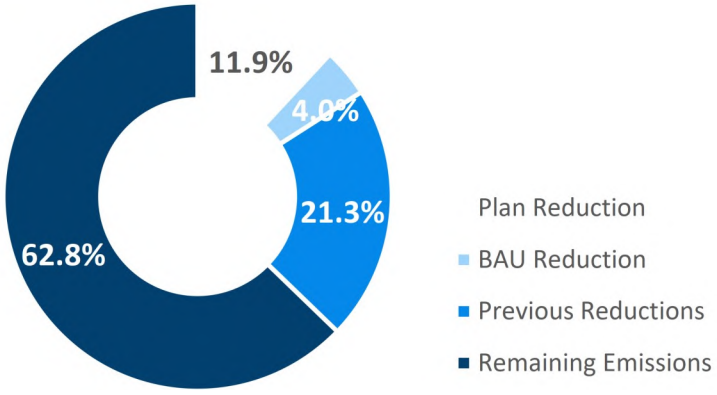
Villagewide GHG Emission Reductions Wedge Diagram



*Commercial numbers include industrial buildings.

Breakdown of GHG Emissions Reductions From 2010 to 2030

Total anticipated GHG emissions reductions by 2030 include emissions reductions which have already occurred since 2010, reductions which are anticipated within the Business-as-Usual forecast, and the reductions resulting from the strategies and actions included in this plan.



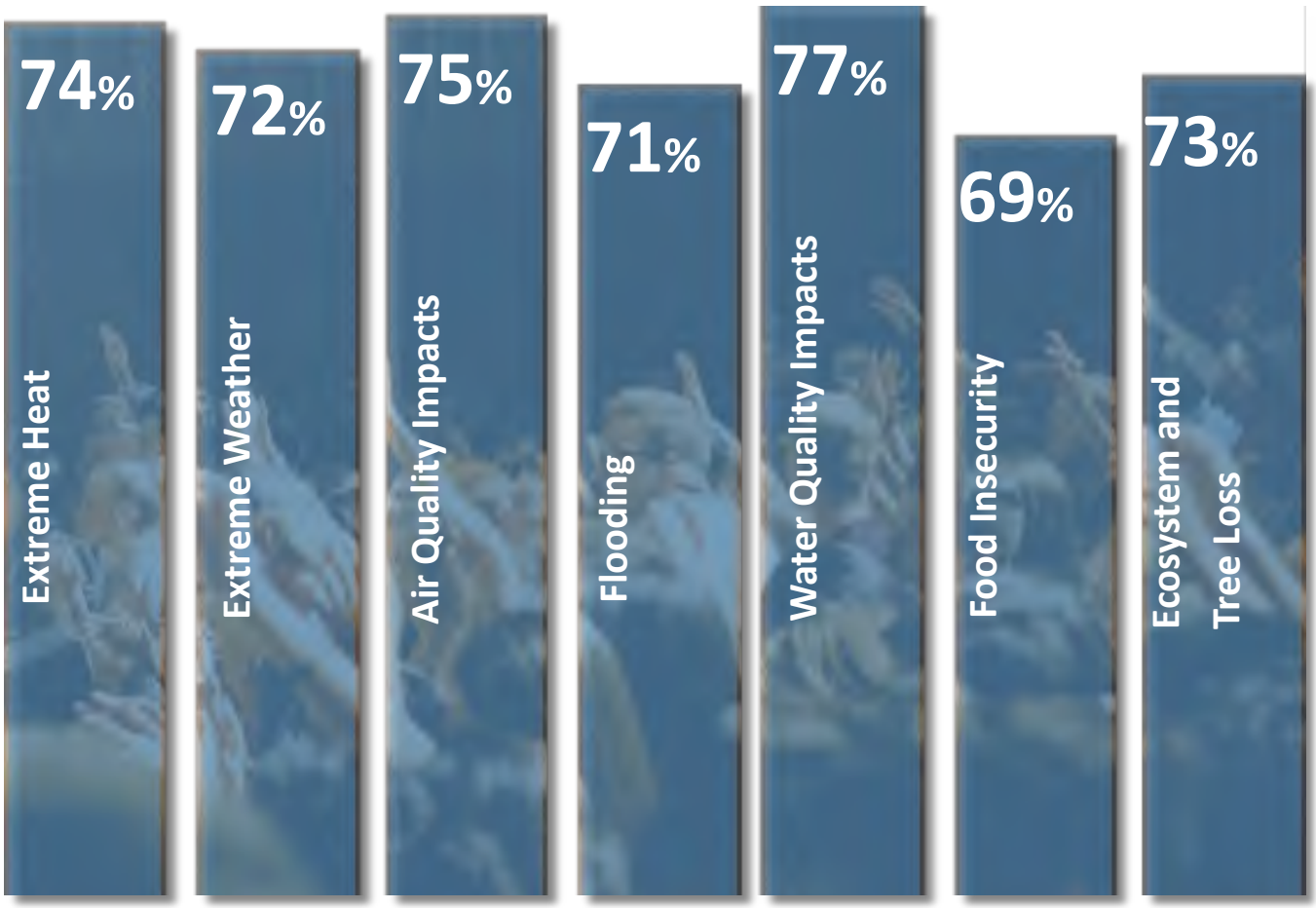
Introduction

Gathering Community Input on Climate Concerns

Understanding the perspectives of community members and broad community input is key to any successful community sustainability or climate planning effort. With that in mind, the Village of Northbrook issued this community survey to collect input from a broad range of community members. The intent of the survey was to help the Village identify climate mitigation and adaptation needs, opportunities, priorities, and issues for the community.

This survey was designed as an on-line questionnaire survey with random self-selected engagement. The survey was designed by paleBLUEdot and reviewed for edit by Village of Northbrook planning staff. The survey was made available on-line on a dedicated webpage and received a total of 418 responses.
(https://www.northbrook.il.us/993/Climate-Action-Plan).

The graph below shows the percentage of respondents that identified each climate change impact topic as a concern. Survey responses, along with other research and community input, helped to inform the strategic goals and actions identified in the plan.



Introduction

The Process

The plan was developed in collaboration with a 31 person planning team of community members, business community members, school district, park district, library, Village commissions, Board of Trustee Liaisons, and Village of Northbrook staff. The planning team was organized into sub-teams aligned with each of the sectors included in this plan (see Plan Framework). The plan was developed through a number of planning workshops from November 2020 through April 2021.

Development and implementation of the Northbrook Climate Adaptation Plan are opportunities for the Village of Northbrook government and partners in the community to research and articulate some of Northbrook's most pressing resilience challenges; identify specific, multi-benefit actions that contribute to solutions to those challenges; and secure additional resources, technical assistance, and partnerships to accelerate next steps.

The goals and actions identified in the Climate Adaptation Plan are grounded in community input, expert analysis, and best practices from other cities throughout the United States. Strategic goals and detailed actions were developed by the Planning Team through a series of workshop meetings. A preliminary draft of actions were reviewed against action screening criteria which enabled the Planning Team to evaluate, refine, finalize, and prioritize the actions to be incorporated in the final Climate Adaptation Plan.

Northbrook Action Screening Criteria

Support: How likely is the proposal to be adopted by the Village or community-wide? Is it politically feasible? Is there community support? Is it consistent with the Village's priorities and readiness to implement?

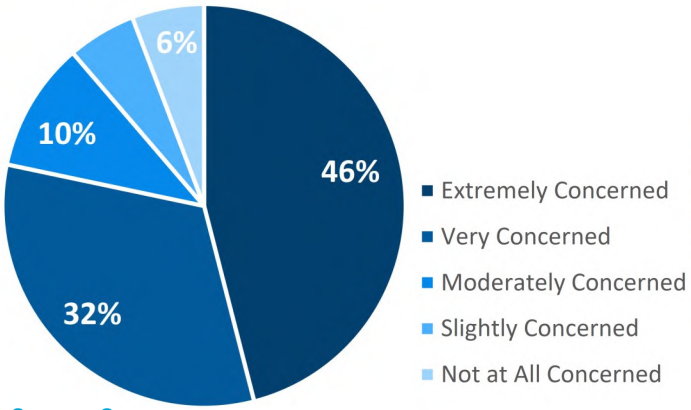
Impact of Implementation: Will it impact a large portion of the targeted emissions sector or population?

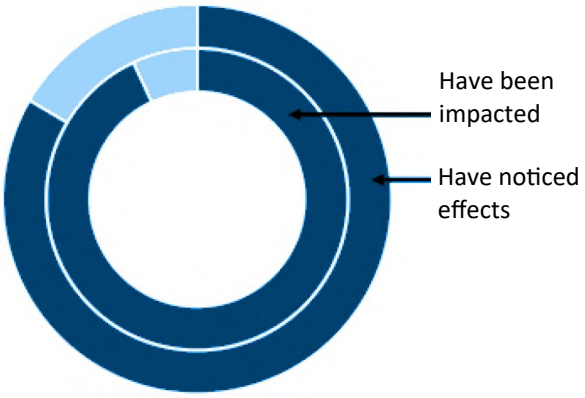
Potential for Success: Do these strategies have a track record for success locally or in other communities?

Affordability: What is the relative ease of covering the costs of the action with Village budget, grants, establishment of progressive fee structures, etc.? How affordable is the action to residents/businesses? What is the relative cost effectiveness of this action?

Overall Benefit to Cost: Does this Action have a good overall cost-to-benefit potential? Overall cost-to-benefit should include:

- Benefits relative to GHG emissions reductions (cost of carbon),
- Other direct benefits such as operational cost savings or community savings,
- Co-benefits such as economic development potential, equity, quality of life potential, health benefits
- Avoided costs including avoided costs of "business as usual" impacts if Action was not implemented.
- The relative ease of covering the costs of the action with Village budget, grants, establishment of progressive fee structures, etc.
- The affordability of the action to residents/ businesses.





Survey Says

Of the community survey respondents, 78.3% are Very Concerned (32.3%) or Extremely Concerned (46%) about Climate Change.

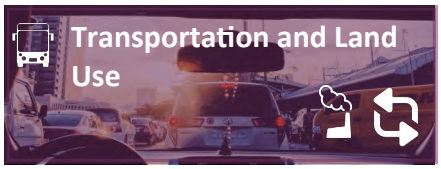
Over 93% have noticed effects of climate change and over 83% have been impacted by effects of climate change.

Introduction

Climate Action Plan Framework
This Climate Action Plan includes an implementation framework designed to achieve community-wide goals for greenhouse gas reduction and climate adaptation and resilience. The plan is organized around a unifying framework organized by sector as illustrated to the right. Each sector has over-arching Strategies established to meet 2030 goals and detailed Actions for implementation. Sector actions include a focus on Climate Mitigation, Climate Adaptation, or both.

Climate Mitigation: addresses the root causes of climate change through the reduction or prevention of greenhouse gas (GHG) emissions. Sectors with this as a significant focus are shown to the right with this symbol:

Climate Adaptation: seeks to lower the risks posed by the impacts of climate change which are now inevitable or likely. Sectors with this as a significant focus are shown to the right with this symbol:



Emissions from on-road vehicle traffic occurring in the community. Approaches to this sector area include reductions in vehicle miles traveled as well as shifts to public transit and alternative modes of transportation like biking and walking. Sector strategies include:

Strategy TL 1: Decrease vehicle miles traveled (VMT) by 2.5% by 2030.

Strategy TL 2: Increase public transit ridership from 11.8% to 14% by 2030.

Strategy TL 3: Increase walk/bike transportation by 50% and expand discretionary walk/bike infrastructure by 2030.

Strategy TL 4: Transition Village fleet to alternative fuels, achieving 50% electrification of the Village's Vehicle and Equipment fleet by 2030.

Strategy TL 5: Support and encourage alternative fuel vehicles, achieve 20% of vehicles sold and 15% reduction of VMT by 2030.

Strategy TL 6: Advance low-carbon land use policy.

Strategy TL 7: Reduce Village wide off-road and lawn equipment annual emissions.

Emissions associated with all electricity and natural gas consumption within the village. Approaches to this sector area include improved energy efficiency and resilience.
Sector strategies include:

Strategy BE 1: Increase on-site distributed renewable energy to 10% of Residential and Commercial electric use by 2030.

Strategy BE 2: Improve Renewable Energy Policy and Incentives.

Strategy BE 3: Educate public on solar and renewable energy.

Strategy BE 4: Increase Residential and Commercial green electricity purchasing Village Wide to 5% by 2030.

Strategy BE 5: Improve total Village owned building and operations energy efficiency by 12% Electricity and 10% Natural Gas by 2030.

Strategy BE 6: Improve total Community wide residential, commercial, and industrial building energy efficiency by 12% Electricity and 10% Natural Gas by 2030.

Strategy BE 7: Achieve 2% natural gas "fuel switching" in community wide residential, commercial, and industrial buildings to reduce on-site fossil fuel use by 2030.

Strategy BE 8: Improve Energy Efficiency Policy and Incentives.

Strategy BE 9: Educate public on energy efficiency.

Introduction

All solid waste generated by residents and businesses within the community and their associated emissions. Approaches in this sector focus on diversion of food, consumer, and construction waste.
Sector strategies include:

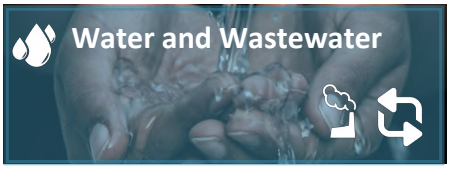
Strategy WM 1: Decrease total per capita municipal solid waste handled by 5% by 2030.

Strategy WM 2: Increase landfill waste diversion to 50% by 2030.

Strategy WM 3: Increase organics diversion from landfill.

Strategy WM 4: Increase recycling rate.

Strategy WM 5: Educate, engage, and empower the public to meet waste management goals.



All potable water, wastewater collection and treatment, flood mitigation, and surface water health. Approaches to this sector focus on water conservation, wastewater reduction, flood mitigation, and stormwater management.
Sector strategies include:

Strategy WW 1: Promote increased water conservation Village Wide with a targeted reduction of 7.5% by 2030.

Strategy WW 2: Mitigate the projected increased flood hazards and impacts due to climate change.

Strategy WW 3: Update design standards and plans to meet projected climate change flood requirements.

Strategy WW 4: Increase stream, river and wetland protection & restoration.

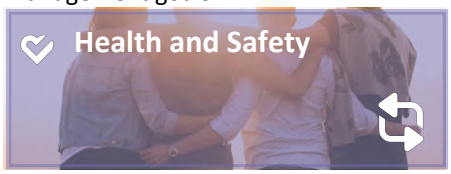
Food cultivation and distribution, nutrition insecurity, and food waste. Approaches to this sector include reduction of food waste, food system resilience, strengthening of local food production, and equitable access to healthy food. Sector strategies include:

Strategy LF 1: Increase production of local food, particularly serving low income and food insecure individuals.

Strategy LF 2: Increase access and interconnect all community gardening.

Strategy LF 3: Reduce food waste and hunger.

Strategy LF 4: Improve local food resilience and availability.



Community health impacts and resilience in the face of current and projected climate impacts & risks. approaches in this sector focus on community resilience and connections.
Sector strategies include:

Strategy HS 1: Establish and expand public health communication to include climate change impacts.

Strategy HS 2: Assist the village's heat, flooding, storm, and poor air quality vulnerable population in preparing for and mitigating climate change impacts.

Strategy HS 3: Include climate impacts and health risks in new and updates to existing plans and policies.

Strategy HS 4: Strengthen community response capacity and support networks.

Strategy HS 5: Address the air quality risks associated with climate change.

Resilience of urban tree canopy, ground cover, greenspace, parks, and ecosystems. Focus includes expansion of tree canopy coverage, improvement of beneficial use of lawn areas, and mitigation of heat island impacts.
Sector strategies include:

Strategy GS 1: Increase Tree Cover and Diversity.

Strategy GS 2: Increase the resilience and use of Native Species and Pollinator Restorations Areas with a targeted increase of 1.5% communitywide land pollinator restoration coverage.

Strategy GS 3: Reduce, repurpose, and reimagine lawn space.

Strategy GS 4: Reduce Heat Island Effect through Village Wide impervious surface reduction of 2% by 2030 and 5% by 2040.

Economic development, jobs, and business creation potential represented by the actions and goals of all sectors in this Climate Action Plan. Approaches include workforce and economic development, and resilience of businesses. Sector strategies include:

Strategy CE 1: Capture local economic potential of climate action.

Strategy CE 2: Increase workforce development for the climate economy.

Strategy CE 3: Build marketplace climate resilience.

Strategy CE 4: Financing The Village's climate action implementation.

Transportation
In Northbrook

146,768,000
Vehicle Miles Driven in 2018

70.5%
Commuters drive alone

11.8%
Commuters use public transit

475
Electric vehicles currently registered

Section 02
Transportation and Land Use

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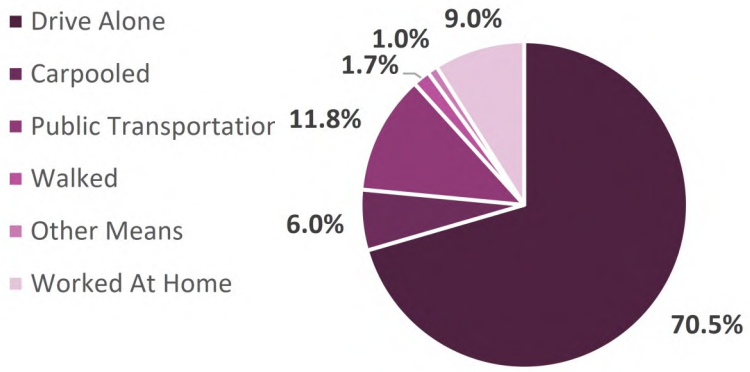
Transportation and Land Use

The design of a Village can limit or expand the choices and opportunities available to its residents. Where and how we live, our mobility to and from the places in our community we visit daily, and the related global impact of those decisions are all influenced by how our community is designed. The transportation systems we have access to and choose to use—including private and public vehicles, trains, and planes - can have significant impacts on the environment.

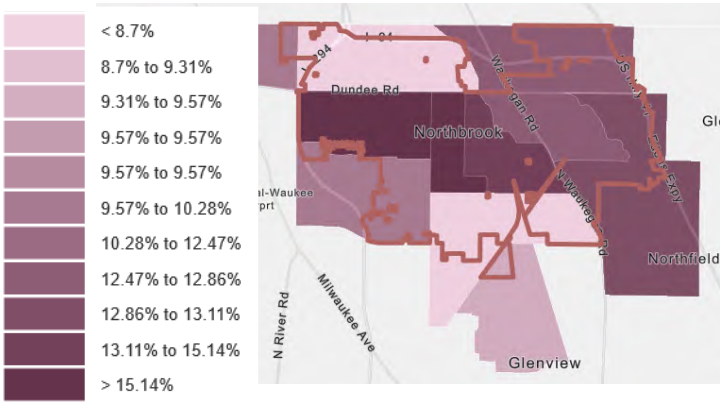
In Northbrook, the transportation sector accounts for 14.8% of villagewide greenhouse gas emissions (2018 GHG Inventory). As shown in the commuter transportation pie chart to the right, the majority (70.5%) of Northbrook residents drive to work alone. The remaining use public transit (11.8%), telework (9%), carpool (6%), or walk /bicycle (2%).

Of the workforce in Northbrook, the average commute-to-work time is 27 minutes compared to the State of Illinois average of 29 minutes. Nearly 12% of commuters have a commute of less than 10 minutes. This population may represent a significant opportunity for converting commute mode from driving to public transit, biking, or walking.

Commuter Transportation Modes of Workers in Northbrook



Commuters with <10 Minute Commute in Northbrook



Continuing to improve the equity and sustainability of Northbrook's land use and transportation systems requires a focus on developing systems and networks that allow for greater choice in where residents live and work, as well as how they commute. Implementation of Complete Streets and a connected system of transit, bike and pedestrian infrastructure along with emphasis on neighborhood design that supports well designed density and walkability. These strategies are lower cost solutions that will save households money while helping Northbrook reach its goal to reduce villagewide GHG emissions by 2030.

Climate Change Considerations

Climate Impacts

This sector impacts climate change through the combustion of fossil fuels (gasoline, diesel, propane) for on-road cars and trucks and off-road vehicles and equipment.

Climate Hazards

Hazards to transportation and land use include increased damage to roads and transportation infrastructure due to increased freeze and thaw cycles, flooding, and extreme weather and temperatures.

Transportation and Land Use

Equity Considerations

- Increased opportunities for public transit and active transportation can help address health disparities for many at-risk populations.
- Affordable and reliable options for mobility for people with special transportation needs can significantly improve transportation equity. Populations with special transportation needs include older adults, youth, persons with disabilities, and persons with reduced incomes.
- Some neighborhoods in Northbrook have fewer housing and transportation options than others. This can limit people's choices in where they live and how they get to work or other activities. Households that rely on public transit service or who rent their home will be limited in where they may find housing that meets both needs.

Mode Shift Targets Supporting Sector Goals

Sector goals are established to both support the Village's Climate Action Plan in creating a climate resilient community and to reduce village-wide GHG emissions 35% below 2010 levels by 2030.

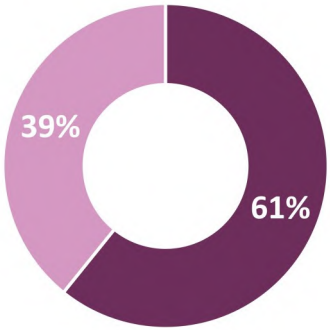
	Northbrook Transit Use	Single Occupancy Vehicle Use	Walk + Bike	Electric Vehicles
	+	-	+	+
Today	11.8%	70.4%	2%	0.5% (Statewide Ave)
2030 Targets	14%	67.9%	3%	20%

Strategies Supporting Sector Goals

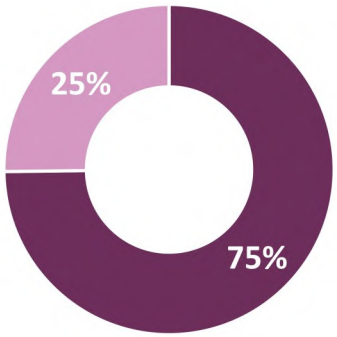
1. **Strategy TL 1:** Decrease vehicle miles traveled (VMT) by 2.5% by 2030.
2. **Strategy TL 2:** Increase public transit ridership from 11.8% to 14% by 2030
3. **Strategy TL 3:** Increase Walk/Bike Transportation 1% by 2030.
4. **Strategy TL 4:** Transition Village fleet to alternative fuels, achieving 50% electrification of the Village's Vehicle and Equipment fleet by 2030.
5. **Strategy TL 5:** Support and encourage alternative fuel vehicles, achieve 20% of vehicles sold and 15% of VMT by 2030.
6. **Strategy TL 6:** Advance low-carbon land use policy.
7. **Strategy TL 7:** Reduce Village wide off-road and lawn equipment annual emissions.

Community Survey Responses Supporting Actions in Sector

Would you support using taxpayer dollars to install electric vehicle charging stations for the public at key locations in the village?



Would you Support the Village in replacing its fleet vehicles with hybrid and electric vehicles?



Transportation and Land Use

1 Strategy TL 1:

Decrease vehicle miles traveled (VMT) by 2.5% by 2030.

	Actions	Implementation Phase
TL 1-1	Execute a community Complete Streets assessment to identify percentage of streets in compliance with Village's complete streets policy. Assessment should recommend 10 year compliance goals outlining percentage of streets to be renovated to be within compliance, recommend prioritized streets for renovation, and establish an implementation plan.	**1**
TL 1-2	Work with local businesses to promote tele-working as an alternative to commuting.	1
TL 1-3	Prioritize transportation funding for Vision Zero engineering improvement projects to create safe streets for people walking, biking and riding transit.	2

2 Strategy TL 2:

Increase public transit ridership from 11.8% to 14% by 2030
(increase to be focused on currently underserved populations, particularly low income individuals and households without vehicle access).

	Actions	Implementation Phase
TL 2-1	Advance improved mobility options for youth and seniors such as shifting student transportation modes from cars to school bus system and promotion of services such as the PACE dial-a-ride, PACE Paratransit, and Senior Cap services.	1
TL 2-2	Explore frequent service transit to the village's many employment centers	1
TL 2-3	Work with local employers encouraging them to implement subsidized or discounted transit program. Explore TMA Lake-Cook and others for potential partnerships. http://tmalakecook.org/	1
TL 2-4	Study mobility limitations and challenges for youth and seniors not addressed in existing programs and services and explore additional mobility options and programs with partners to address limitations while decreasing community vehicle miles traveled.	2
TL 2-5	Establish parking maximums for new development within 3/4 mile of existing or future rail or rapid bus stations.	2

3 Strategy TL 3:

Increase walk/bike transportation by 50% and expand discretionary walk/bike infrastructure by 2030 (of total commute).

	Actions	Implementation Phase
TL 3-1	Identify locations, especially near shopping and business districts, where additional bike parking facilities could be installed	1
TL 3-2	Identify locations and partners to facilitate parking buyback programs for municipal and other employers in the village. (https://www.bestworkplaces.org/pdf/ParkingCashout_07.pdf https://www.boston.gov/transportation/parking-cash-out)	1
TL 3-3	Leisure biking: Connect Northbrook - via protected bike lanes - to key biking corridors to the west of 294 (Des Plaines River Trail) and east of 94 (North Branch Trail).	2
TL 3-4	Implement the recommendations of the Northbrook Master Bicycle and Pedestrian Plan.	2
TL 3-5	Continue to support and implement Safe Routes to Schools programs. Ensure every Northbrook school has had a Safe Routes assessment and plan. Implement all plan recommendations.	3

4 Strategy TL 4:

Transition Village fleet to alternative fuels, achieving 50% electrification of the Village's Vehicle and Equipment fleet by 2030 (measured by fuel consumption).

	Actions	Implementation Phase
TL 4-1	Conduct a municipal fleet inventory and EV transition Implementation plan. Effort to identify opportunities for electrifying, right-sizing, and improving overall efficiency of vehicles to meet CAP Goals. Include implementation recommendations to incorporate EV's through right-timing purchases with a planned vehicle-replacement schedule.	1
TL 4-2	Update Village vehicle purchasing policy and budget process to default to alternative fuel with traditional internal combustion engine (ICE) as optional requiring proof of need and lack of EV option meeting use case. Focus on small vehicles as well as large vehicles for alternative fuels. EV replacement to be prioritized for high mileage vehicles. Goal: Achieve 50% EVs within Village Fleet by 2030. For unavoidable approved ICE vehicle purchases, establish minimum fuel efficiency requirements.	2

5 Strategy TL 5:

Support and encourage alternative fuel vehicles, achieve 20% of vehicles sold and 15% of VMT by 2030.

	Actions	Implementation Phase
TL 5-1	Coordinate with Cook County as needed to establish or maintain tracking of EV registration within the community.	1
TL 5-2	Expand Northbrook's current residential "EV Ready" code requirement to include all new developments (residential, multi-family, commercial, institutional, educational, industrial). Requirement to include wiring capacity to charge electric vehicles and EV parking requirements to reserve a percentage of parking spots for exclusive EV use.	1
TL 5-3	Support State efforts to adopt a low-carbon fuel standard.	1
TL 5-4	Proactively encourage the safe use of non-car electric vehicles such as e-bikes and scooters on village rights of way.	1
TL 5-5	Modify future waste hauler agreements with haulers serving Northbrook to include progressive EV fleet requirements, with the goal of 50% EV fleet by 2030 and 100% by 2035. Example: City of Evanston	1
TL 5-6	Create an Electric Vehicle (EV) Action Plan to guide access to chargers on Village property and village wide, explore alternative technologies like Smart cable technology and streetlight/EV charger integration, address barriers to charging for garage-free homes and rental properties, increase use of EVs in car sharing programs, assess options to lower EV and EV charger implementation costs, and recommend EV charging station requirement amendments to zoning ordinances to support EV plan. EV Action Plan should consider EV charging needs for village residents and businesses as well as consider opportunities to support EV re-charging for travelers in ways which support the community as well as the traveler. Resource for an EV Action Plan: https://mayorscaucus.org/wp-content/uploads/2020/08/EV-Readiness-CHECKLIST-01Jun2020_final.pdf	1
TL 5-7	Establish an expedited process through the Village's zoning and building code for electric vehicle charging infrastructure.	2
TL 5-8	Partner with local businesses to install EV charging stations outside their store fronts for patron use.	2
TL 5-9	Identify and promote information on grants, incentives, and rebates available to the public for adoption of EV charging equipment an EV vehicles.	2
TL 5-10	Village to explore strategies to offset or reimburse part or all of the increased State of Illinois vehicle sticker fee for EV cars.	2
TL 5-11	Partner with private sector and other public sector fleet operators and transit providers to work towards a goal of 100% electric fleets within Northbrook by 2035 (50% electric by 2030).	2
TL 5-12	Identify, explore, and offer incentives to advance equity of EV adoption and use.	2

6 Strategy TL 6:
Advance low-carbon land use policy.

	Actions	Implementation Phase
TL 6-1	Amend the zoning ordinance to allow and encourage higher density development within the downtown district and within 3/4 mile radius of transit centers. These amendments should include increasing building heights, allowing projects to build out to approved densities, and should consider opportunities for mixed land use. Increased density can minimize vehicle miles travelled.	1
TL 6-2	Use regulatory and voluntary tools to promote affordable and accessible housing development along existing and planned high capacity transit lines, frequent transit routes and in opportunity areas identified by Northbrook Development and Planning.	1
TL 6-3	Reconsider Village parking requirements and establish revisions which support the goals of this plan such as reducing overall parking requirements, establishing parking maximums, and elimination or reduction of parking minimums. Particular focus should be given to the Transit Oriented Development areas within a ¾ mile radius of train station and transit stops.	1
TL 6-4	Incentivize infill and mixed-use development (e.g., through alternative code compliance, fee waivers, density bonuses, investment prioritization, development impact fees, tax benefits)	2
TL 6-5	Allow the construction of accessory dwelling units to increase rental opportunities in both established neighborhoods and new development.	2

7 Strategy TL 7:
Reduce village wide off-road and lawn equipment annual emissions.

	Actions	Implementation Phase
TL 7-1	Develop an incentive program to convert fuel-burning lawn equipment such as gas-powered lawn mowers and blowers to electric. Incentive should focus on increasing community equity. (For GHG impacts, see: http://palebluedot.llc/carbon-copy/2015/7/16/the-carbon-footprint-of-a-lawn)	1
TL 7-2	Develop ordinances to prohibit fossil-fuel-powered lawn and yard equipment.	2

Transportation and Land Use

Planned Transportation and Land Use GHG Emission Reductions

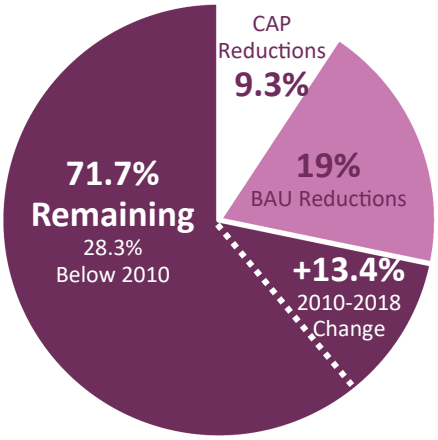
Planned Sector Emission Reductions Through 2030

The strategies and actions included in this section of the Climate Action Plan are projected to reduce the Village's annual GHG emissions by 6,273 metric tons (MT) by 2030 - a 9.3% reduction over 2010 levels. Changes in business-as-usual impacts over the same period are anticipated to reduce an additional 21,886 metric tons, however, previous changes between 2010 and 2018 increased emissions in this sector by 9,039 metric tons. The result is a total community wide Transportation sector reduction of 29% over 2010 levels.

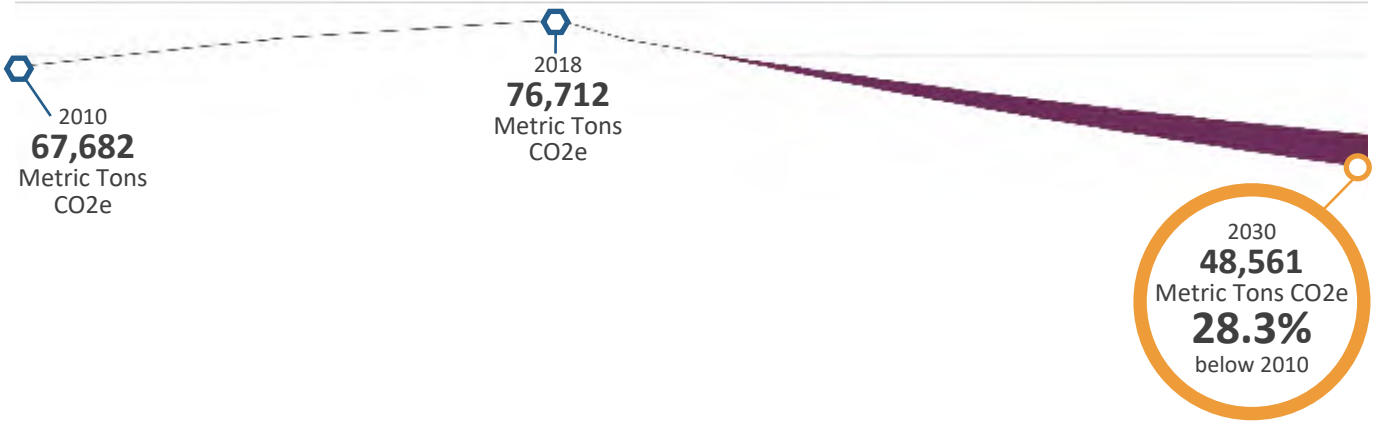
When compared to 2010 emissions, this is equivalent to eliminating **375 million** cubic feet of man-made greenhouse gas atmosphere annually by 2030

Sector Emissions Reduction below 2010 by 2030

The total change to sector emissions include CAP Plan reductions, BAU emission changes, and previous changes between 2010 and 2018 as follows:



Northbrook's Transportation and Land Use Carbon Reduction Pathway



Estimated Cumulative Economic Savings

Implementing many of the measures in this plan, such as reduction of single-occupancy auto use, can save money for the community. The estimated community savings of the goals for this section include:

Decrease VMT by 2.5%:		Increase EV utilization to 15% of VMT		Estimated Cumulative Savings Potential*
$38,522,798	+	**$4,651,059**	=	**$43,173,856**
$1,161 per capita		**$359** per household		**$1,302** per capita

* Savings for VMT reductions are based on multiplying the estimated vehicle miles saved by AAA calculated auto use cost per mile and 2020 PACE transit pass costs. Savings for EV utilization are calculated based on multiplying the estimated vehicle miles switching from gas/diesel fuel vehicle by the sum of the AAA calculated gas/diesel auto use cost per mile subtracting the EPA estimated EV auto use cost per mile. See Appendix for Cumulative Potential Cost Savings Assumptions and data sources.

Transportation and Land Use

What You Can Do

You can support the goals of the Transportation and Land Use section of the Northbrook Climate Action Plan as an individual, household, or a business. Here are just a few things you can do:

- Merge two or more errands into a single driving trip.
- Join a carpool or use ridesharing to get to work, a group activity or event.
- Walk to work, an appointment, a group activity or event.
- Ride a bike, electric bike or scooter to work, an appointment, a group activity or event.
- Take public transit to work, an appointment, a group activity or event. Plan your trip here: https://www.pacebus.com/trip-planner
- With a family member or friend, take public transit to a group activity or event.
- Buy or tune up a used bike.
- Sell or donate a bike (in good condition) you aren't using.
- Buy or lease a hybrid or electric vehicle, or a gas-powered one that averages more than 35 mpg.

Buildings + Energy
In Northbrook

426,411,000
kWh of electricity in 2018

34,088,156
therms of natural gas in 2018

160%
of regional household average electric consumption

-25.8%
Change in commercial electricity consumption since 2010

Section 03
Buildings and Energy

Click here to
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Buildings and Energy

Why Buildings and Energy Is Important

Building construction and operations can have extensive direct and indirect impacts on the environment, society, and economy. Buildings use significant resources (energy, water, raw materials, etc.), generate waste (occupant, construction, and demolition), emit potentially harmful atmospheric emissions, fundamentally change the function of land, and the ability of that land to absorb and manage water.

Building energy use is a major contributor to greenhouse gas (GHG) emissions. The Building Energy sector includes all residential, commercial, and industrial buildings. Greenhouse gas emissions from this sector come from **direct emissions** – from fossil fuels burned *on-site* for heating or cooking needs – as well as **indirect emissions** – from fossil fuels burned *off-site* in order to supply that building with electricity. Building design plays a large role in determining the future efficiency and comfort of facilities. Increasing energy efficiency can help reduce GHG emissions and result in significant cost savings for both homes and businesses. The Northbrook community can also achieve environmental, social, and economic benefits through enhancements to the built environment. The Buildings and Energy sector is 77% of villagewide GHG emissions for the Village of Northbrook. Within this sector, the share of residential consumption is 46%, commercial/industrial and government buildings are 54%.

According to 2018 community wide data, the residential sector in Northbrook consumes nearly 157 million kWh annually. This is equal to 12,805 kWh per household compared to the State of Illinois average of 8,796. The sector also consumes over 21 million therms of natural gas annually, equal to 1,685 therms per household compared to the State of Illinois average of 990 therms annually. Based on this data, the average household in Northbrook consumes 146% of the State average electrical consumption and 170% of the State average natural gas consumption.

The commercial and industrial sector in Northbrook consumes 269 million kWh annually, or approximately 8,191 per job in the community. This is compared to the State of Illinois average of 3,715 per job. These sectors also consume over 14.2 million therms of natural gas annually, equal to 434 therms per job compared to the State average of 893 therms annually. Based on a per job basis, the commercial and industrial sectors in Northbrook consume 220% of the State average electrical consumption and 49% of the State average natural gas consumption

Climate Change Considerations

Climate Impacts

This sector impacts climate change through the combustion of fossil fuels (coal, natural gas, heating oil, propane) to generate electricity and heat/cool our buildings.

Climate Hazards

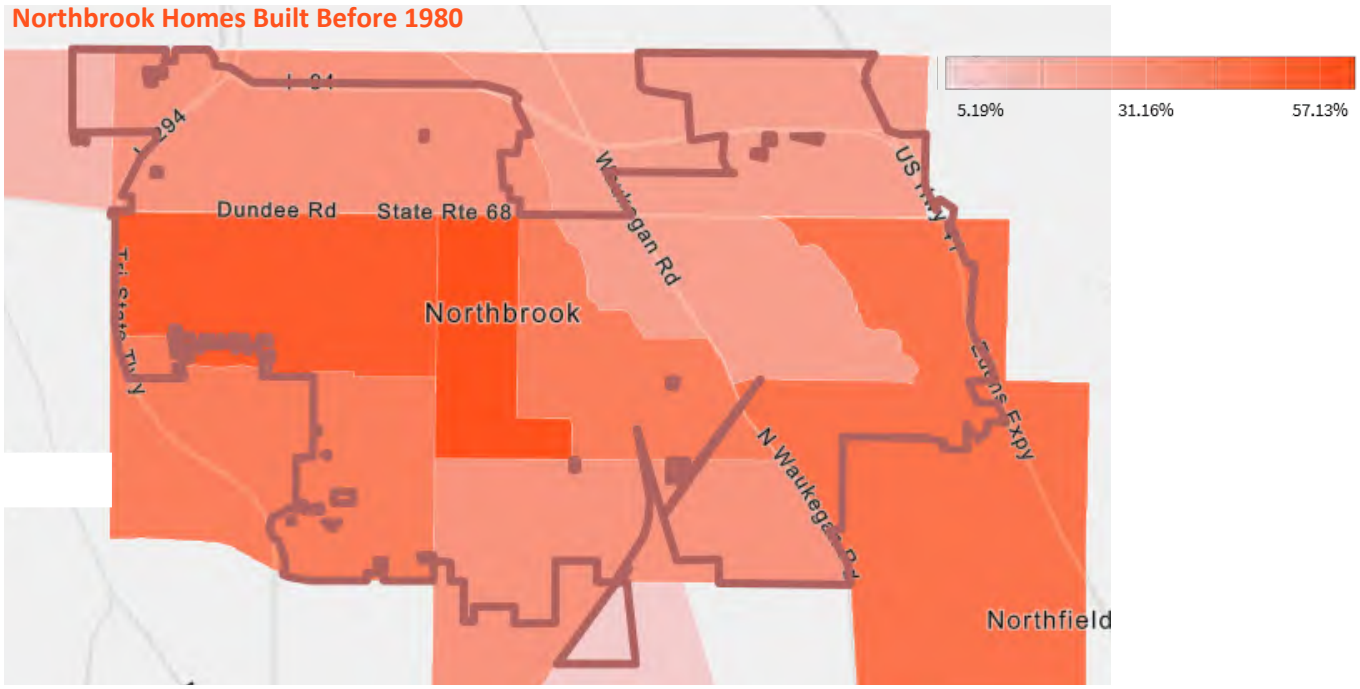
Hazards to Buildings and Energy include damage to buildings and energy grid infrastructure from extreme weather and flooding, increased power outages, and increased energy demand and cost expenditure due to rising temperatures and weather variability.

Buildings and Energy

Northbrook Building Stock Efficiency

The measure of a community's existing building stock, certified high performance buildings, and housing characteristics provides a basis for determining the current and potential energy efficiency gains for the community. Energy and water efficiency upgrades are one of the simplest and most effective ways to conserve resources, save money, and reduce greenhouse gas emissions. New building technology has increased energy efficiency significantly in recent decades. Although newer U.S. homes are 30 percent larger, they consume a similar amount of total energy as older homes - meaning they are more energy efficient per square foot of space. According to the US Energy Information Administration, homes built between 2000 and 2009 used 15% less energy per square foot than homes built in the 1980s, and 40% less energy than homes built before 1950.

Northbrook Homes Built Before 1980



Consequently, this means that retrofitting older homes with some of these technologies provides ample opportunity to improve energy efficiency throughout the community. Below are the estimated annual energy savings potential for households built before 1980:

	Estimated Units		Current Electric Consumption (million kWh)	Potential Electric Savings at 15% Improvement (million kWh)	Village Wide Potential at 15% Participation (million kWh)	Current NG Consumption (million Therm)	Potential NG Savings at 10% Improvement (million Therm)	Village Wide Potential at 15% Participation (million Therm)
Owner Occupied	**9,012**	**84.1%**	**76.44**	**11.47**	**1.72**	**10.17**	**1.02**	**0.15**
Built 1960 to 1979	6,432	60.0%	54.56	8.18	1.23	7.26	0.73	0.11
Built 1940 to 1959	2,252	21.0%	19.10	2.87	0.43	2.54	0.25	0.04
Built 1939 or Earlier	328	3.1%	2.78	0.42	0.06	0.37	0.04	0.01
Renter Occupied	**1,710**	**15.9%**	**14.50**	**2.18**	**0.33**	**1.93**	**0.19**	**0.03**
Built 1960 to 1979	1,022	9.5%	8.67	1.30	0.20	1.15	0.12	0.02
Built 1940 to 1959	603	5.6%	5.11	0.77	0.12	0.68	0.07	0.01
Built 1939 or Earlier	85	0.8%	0.72	0.11	0.02	0.10	0.01	0.00
Total Housing Units Built Before 1980:	**10,722**				**2.05**			**0.18**

Northbrook Renewable Energy Market Potential

As outlined in the Northbrook Renewable Energy Potentials Study, a number of scenarios for potential future market absorption of on-site solar installations exist. Scenario C outlined below, represents a continued market adoption rate within the community based on installed capacity as follows:

> Scenario C: Northbrook Rooftop Solar PV Share of Statewide Projections Based on Current Share of Installed KW. This scenario also assumes maintaining the Village's leadership position in its share of the statewide ***number*** of arrays anticipated over the next 5 years while also maintaining the Village's leadership position in terms of its share of the statewide installed ***generating capacity*** (KW). By 2025, this Scenario results in a total installed capacity equal to approximately 12.6% of the total rooftop technical capacity potential or 17.2% of the optimized capacity potential within the Village.

The chart below shows projections through 2040 using the assumptions outlined above.

Scenario C: Northbrook Rooftop Solar PV Share of Statewide Projections Based on Current Share of Installed KW Capacity

(62% Initial Annual Increase)

Year	Cumulative Installed (KW)	Annual Generation (KWH)	% of Village Electric Consumption	This is Equivalent to adding (x) Average Residential Arrays Annually:	Or Equivalent to adding (x) Commercial Arrays Annually:	Or Equivalent to adding (x) Arrays Annually with Average Array Size Equal to Current Community Ave:
2024	14,264	15,399,202	**3.61%**	**359**	**61.0**	**89.5**
2030	38,728	41,810,332	**9.81%**	**948**	**124**	**179.6**
2040	110,519	119,315,514	**27.98%**	**1,421**	**215**	**263.5**

Equity Considerations

- Often, families that live in properties that are not energy efficient are also those that can least afford high-cost utility bills. These households may lack the ability to pay for energy efficiency improvements or access renewable energy options.
- Renters of both single family homes as well as multi-family housing usually do not have the ability to implement energy efficiency measures to the buildings they live in to gain the benefits of energy efficiency.
- Families with fewer resources must dedicate a disproportionately larger share of their income towards energy costs, which exacerbates other vulnerabilities including exposure to heatwaves and other climate vulnerabilities. These same families are sometimes forced to forego basic access to service altogether - an estimated 87 households in Northbrook go without heating fuel of any type (US Census heating fuel utilization data).

Buildings and Energy

Energy Mix Targets Supporting Sector Goals

Sector goals are established to both support the Village's Climate Action Plan in creating a climate resilient community and to reduce village-wide GHG emissions 35% below 2010 levels by 2030.

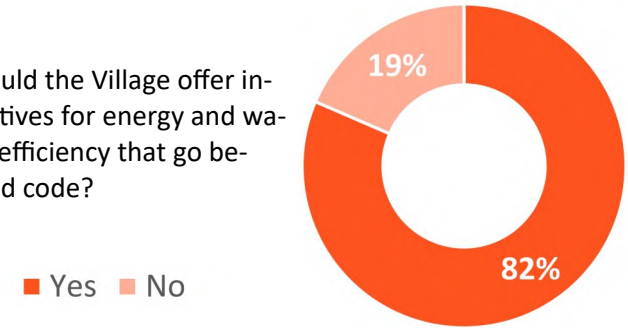
	Villagewide Renewable Energy	Villagewide Electricity Consumption	On-Site Fossil Fuel Consumption
	+	-	-
Today	0.2%	426GHW	34.1MTherms
2030 Targets	10%	375GWH	30.7MTherms

Strategies Supporting Sector Goals

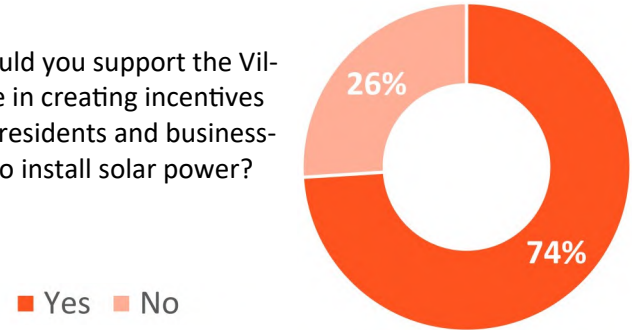
1. **Strategy BE 1:** Increase on-site distributed renewable energy to 10% of Residential and Commercial electric use by 2030.
2. **Strategy BE 2:** Improve Renewable Energy Policy and Incentives.
3. **Strategy BE 3:** Educate public on solar and renewable energy.
4. **Strategy BE 4:** Increase Residential and Commercial green electricity purchasing Village Wide to 5% by 2030.
5. **Strategy BE 5:** Improve total Village owned building and operations energy efficiency by 12% Electricity and 10% Natural Gas by 2030.
6. **Strategy BE 6:** Improve total Community wide residential, commercial, and industrial building energy efficiency by 12% Electricity and 10% Natural Gas by 2030.
7. **Strategy BE 7:** Achieve 2% natural gas "fuel switching" in community wide residential, commercial, and industrial buildings to reduce on-site fossil fuel use by 2030.
8. **Strategy BE 8:** Improve Energy Efficiency Policy and Incentives.
9. **Strategy BE 9:** Educate public on energy efficiency.

Community Survey Responses Supporting Actions in Sector

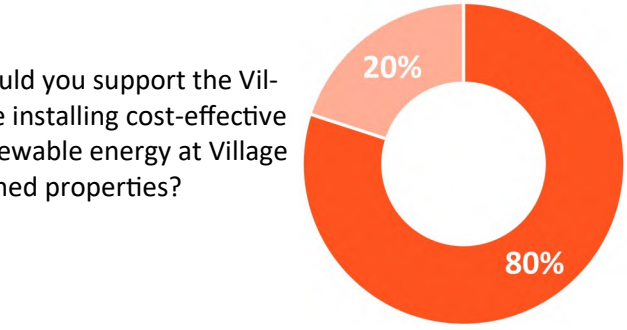
Should the Village offer incentives for energy and water efficiency that go beyond code?



Would you support the Village in creating incentives for residents and businesses to install solar power?



Would you support the Village installing cost-effective renewable energy at Village owned properties?



Buildings and Energy

1 Strategy BE 1:

Increase on-site distributed renewable energy to 10% of Residential and Commercial electric use by 2030.

	Actions	Implementation Phase
BE 1-1	Use Village facilities and other leading edge businesses and institutions to showcase clean energy systems and promote the technical and financial information needed to support broader scale adoption. Conduct a renewable energy potentials assessment and 100% Renewable Energy Master Plan for all Village owned facilities and operations. Master Plan should include exploration of on-site renewable options, community/shared renewable options, and Renewable Energy Credit (REC) options and provide an implementation plan for achieving 50% renewable energy for all Village facilities and operations by 2030, and a pathway to achieve 100% by 2040. Encourage school district, county, and other public entities owning property within Village to conduct similar plans. Use Village facilities and other leading edge businesses and institutions to showcase clean energy systems and promote the technical and financial information needed to support broader scale adoption. This strategy could be coordinated with a Commercial property and Industrial property Solarize program.	1
BE 1-2	Sponsor a community-wide "Solarize" program for residential group purchase of Solar PV. Explore use of Village staff, consultant support, resources, or financing mechanisms to support the required reach of annual solarize programs to achieve long-range goals. (goal, 140 homes installed annually) https://www.nrel.gov/docs/fy12osti/54738.pdf	1
BE 1-3	Promote/Implement solar panels across the commercial/Industrial buildings. Identify and engage a partner that would lease roofs to create solar panel fields, as a tenant who could generate power on the roofs and sell the power directly to ComEd	1
BE 1-4	Identify the "Solar Top 50" commercial/industrial properties within the Village and produce detailed solar feasibility assessments for each site. Assessments to include potential solar generation and economic performance and return on investment estimates, information on financing and ownership models, and next step resources. Provide solar assessment reports to properties, free of charge, and conduct an informational workshop to assist building owners and businesses in understanding the assessments and next step potential. "Solar Top 50" assessment effort could be repeated annually, particularly through 2025 to leverage federal tax incentive potential.	2
BE 1-5	Sponsor a community-wide "Solarize" program for commercial and Industrial group purchase of Solar PV. Include an invitation to participate to all building sites included in the "Solar Top 50" feasibility effort. Explore use of Village staff, resources, or financing mechanisms to support the required reach of annual solarize programs to achieve long-range goals. (goal, installed capacity equal to 1.1% of commercial/industrial sector electrical consumption annually) https://palebluedot.llc/solar-pv-group-purchasing	2

2 Strategy BE 2:
Improve Renewable Energy Policy and Incentives.

	Actions	Implementation Phase
BE 2-1	Require a Solar PV Site Assessment as a part of all building permit submissions. Assessment should include estimated installation cost, and projections for both energy generation potential and economic payback potential over a minimum 20 year timeframe.	1
BE 2-2	Establish a Solar Ready Ordinance to require residential and encourage all new multi-family residential and commercial buildings to be solar ready based on Village's Solar Ready Guide, with flexibility for site suitability.	2
BE 2-3	Collaborate with other communities, the Metropolitan Mayors Caucus, industry, and state agencies to support County and State clean energy policies which support CAP goals. Each legislative session, prioritize proactive clean energy policies, such as: State Renewable Portfolio Standard Increase (e.g., 25% by 2025), improved net-metering laws, legislation that allows Residential PACE Programs	2

3 Strategy BE 3:
Educate public on solar and renewable energy.

	Actions	Implementation Phase
BE 3-1	Help showcase renewable energy at local fairs and events (Earth Day, etc). Work with education partners like Go Green, Library and schools at events like Earth Day.	1
BE 3-2	Establish a Solar Ready Guide providing building owners, renters, developers, designers, and contractors with detailed information on strategies to make new construction or significant renovation projects fully Solar Ready enabling more cost efficient and easier installation of on-site solar arrays. Engage solar installation companies in the process of drafting solar-ready requirements. https://view.publitas.com/palebluedot/llbo-solar-ready-guidelines/	2
BE 3-3	Establish and promote a renewable energy and energy efficiency resource hub to promote education on strategies, resources, benefits, financing, incentives, and rebate opportunities,	2

Buildings and Energy

4 Strategy BE 4:
Increase Residential and Commercial green electricity purchasing (wind and solar source) Village Wide to 5% by 2030.

	Actions	Implementation Phase
BE 4-1	Promote green power purchase options such as those provided by ComEd and Nicor. Collaborate with utilities on promotion and education of available options.	1
BE 4-2	Continue and expand on existing community solar project. Organize, issue, and promote a Request for Proposals for community solar developments capable of serving Village residents and businesses interested in subscribing, particularly low income renters and home owners. Community solar development may be within or outside of Village boundary. Provide communications and subscription procurement support to selected community solar developer. Goal: 150 new community solar subscriptions annually.	2

5 Strategy BE 5:
Improve total Village owned building and operations energy efficiency by 12% Electricity and 10% Natural Gas by 2030.

	Actions	Implementation Phase
BE 5-1	Convert municipal streetlights to LEDs. Explore other opportunities for smart lights that can further save energy through conservation with features like motion sensors. Achieve 100% LED conversion by 2030.	1
BE 5-2	Establish a Green Building policy for Village owned properties requiring clear energy efficiency goals, energy consumption reduction requirements, and on-site fossil fuel combustion reduction and elimination goals. Policy to require energy consumption to be benchmarked and disclosed annually. Encourage churches, schools, YMCA, Park District, and other public and private agencies to establish similar policies.	1
BE 5-3	Conduct a building energy audit including building electrification and occupancy / plug load energy efficiency assessment on all primary Village owned facilities. Establish a timeframe to fully implement audit recommendations. Prioritization should be given to the Village's largest energy consuming sites.	2
BE 5-4	Establish a policy requiring ENERGY STAR appliances for all eligible new Village equipment purchases.	2

6 Strategy BE 6:

Improve total Community wide residential, commercial, and industrial building energy efficiency by 12% Electricity and 10% Natural Gas by 2030.

	Actions	Implementation Phase
BE 6-1	Work with partner organizations to establish a Large Business Energy Efficiency program to promote building retro commissioning and operation and maintenance practices that improve affordability, comfort, indoor air quality, energy efficiency, and smart metering in commercial and multifamily buildings. Target 10 large businesses commissioned annually.	1
BE 6-2	Work with ComED, Nicor, and other potential partners to promote and expand residential and multi-family energy efficiency audit and upgrade program similar to ComEd's "Home Energy assessments". Target 150 households per year (https://www.comed.com/waystosave/foryourhome/pages/singlefamily.aspx https://www.comed.com/WaysToSave/ForYourHome/Pages/MultiFamily.aspx and https://www.nicorgas.com/residential/ways-to-save/free-products-and-services.html)	2
BE 6-3	Identify and promote available energy efficiency and weatherization programs serving under-resourced households. Collaborate with partners including Illinois AmeriCorps program, Greenest Region Corps, ComEd, Nicor, and local community organizations serving under-resourced households to establish program promotion content and communication pathways.	1
BE 6-4	Work with partner organizations to establish a Small Business Energy Efficiency program to promote building retro commissioning and operation and maintenance practices that improve affordability, comfort, indoor air quality, energy efficiency, and smart metering in commercial and multifamily buildings. Target 50 small and medium businesses commissioned annually.	2
BE 6-5	Through the EQC, ComEd, Nicor, and community partners like Go Green Northbrook, create a residential energy efficiency challenge. Establish annual targets of households to engage and energy efficiency targets for participants. Collect communication materials to share with residents. Develop a plan to drive residents to action; Identify other community groups that can build capacity for effective outreach; publicly recognize annual challenge "winners" with successful energy reduction achievements. Track annual progress; Combine efforts with increased renewable energy purchases and installations	2

Buildings and Energy

7 Strategy BE 7:

Achieve 2% natural gas "fuel switching" in community wide residential, commercial, and industrial buildings to reduce on-site fossil fuel use by 2030.

	Actions	Implementation Phase
BE 7-1	Conduct an "Electrification Assessment and Action Plan" to outline actions and priorities for electrification of all Village owned facilities to move towards zero on-site fossil fuel combustion. Work with regional energy partnerships to implement plan for all Village facilities. Include new and existing buildings, explore strategies to address electricity storage, and create a case study to highlight and share challenges, solutions, and lessons learned to share with the broader community.	1
BE 7-2	Educate residents and businesses about the benefits of replacing fossil fuel burning heating equipment and with air-source heat-pumps, or other efficient electric heating options. Collaborate with ComEd and education partners like the Library and Go Green Northbrook.	2

8 Strategy BE 8:

Improve Energy Efficiency Policy and Incentives.

	Actions	Implementation Phase
BE 8-1	Create policies to support interior lighting upgrades to LED technology village-wide. Promote and distribute education and information to residents and businesses on advantages of and options for LED technology. Explore options for focused buy-down programs for low-income residents, with graduated approaches for individuals and institutions able to better afford the up-front costs required to secure long-term savings. In addition to energy cost savings, maintenance costs are greatly reduced.	1
BE 8-2	Promote and distribute education and information to residents and businesses on advantages of and options for energy efficient appliances.	2
BE 8-3	Promote and offer incentives for improving energy efficiency (e.g., insulation, energy-efficient windows, electric heat pumps) in new construction and retrofit residential and commercial properties. Coordinate incentive offerings with Utility incentives and PACE financing information (currently available to commercial properties only) New construction incentives shall support measures for projects that exceed code requirements. See Chicago Sustainable Development Policy (https://cutt.ly/TvZIY6D)	2
BE 8-4	Establish an income qualified residential and small business revolving loan fund to advance energy efficiency upgrades. Identify potential partnerships with other organizations for funding and support.	2

9 Strategy BE 9:
Educate public on energy efficiency.

	Actions	Implementation Phase
BE 9-1	Enlist organizers such as schools, park district, Go Green, Library, churches, to support education of energy efficiency and renewable energy strategies and resources in support of this CAP.	1
BE 9-2	Establish a Green Building Resource Center to provide general and technical assistance about green materials, energy efficient appliances and equipment, lighting, renewable energy generation, and to provide information on available rebates to residents and others.	1
BE 9-3	Establish a Net Zero Energy Building Guide providing building owners, renters, developers, designers, and contractors with detailed information on strategies to make new construction or significant renovation projects Net Zero Energy or Net Zero Energy ready. https://view.publitas.com/palebluedot/bloomington-net-zero-energy-building-guide/	2

Buildings and Energy

Planned Buildings and Energy GHG Emission Reductions

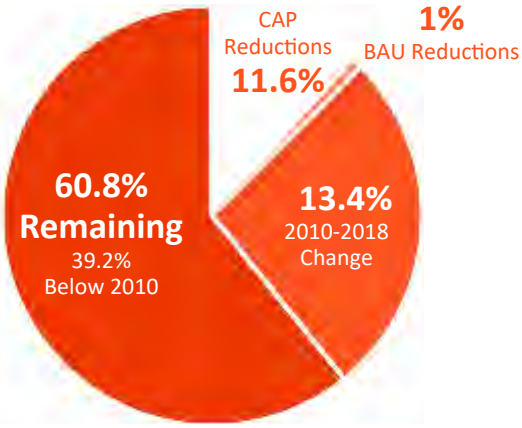
Planned Sector Emission Reductions Through 2030

The strategies and actions included in this section of the Climate Action Plan are projected to reduce the Village's annual GHG emissions by 66,622 metric tons (MT) by 2030 - an 11.6% reduction over 2010 levels. Changes in business-as-usual impacts over the same period are anticipated to reduce an additional 5,116 metric tons and previous changes between 2010 and 2018 decreased emissions in this sector by 152,583 metric tons. The result is a total community wide Buildings and Energy sector reduction of 39% over 2010 levels.

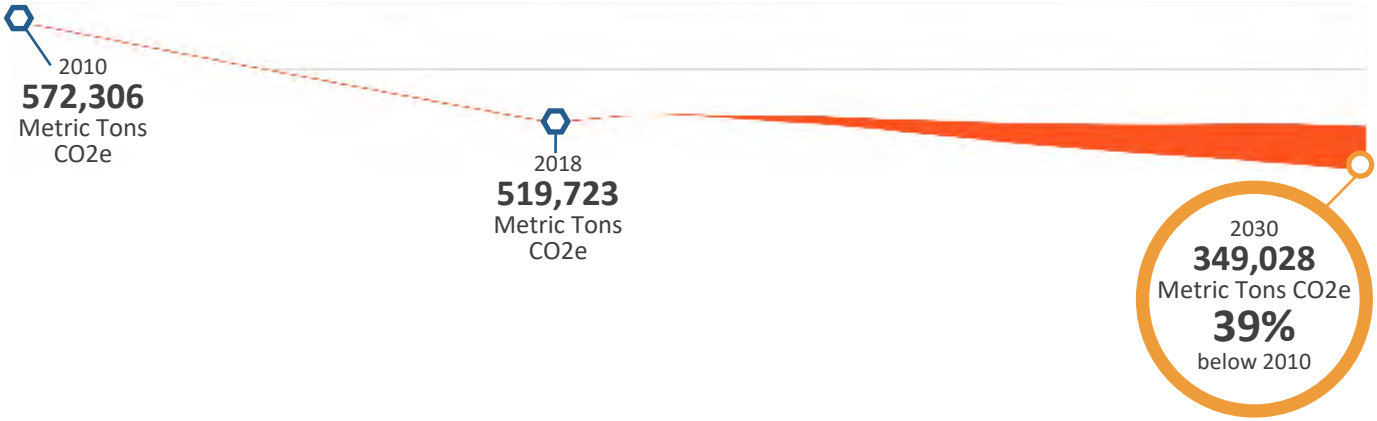
When compared to 2010 emissions, this is equivalent to eliminating **4,380 million** cubic feet of man-made greenhouse gas atmosphere annually by 2030.

Sector Emissions Reduction below 2010 by 2030

The total change to sector emissions include CAP Plan reductions, BAU emission changes, and previous changes between 2010 and 2018 as follows:



Northbrook's Buildings and Energy Carbon Reduction Pathway



Estimated Cumulative Economic Savings

Implementing many of the measures in this plan, such as increased energy efficiency and renewable energy, can save money for the community. The estimated community savings of the goals for this section include:

Residential Energy Efficiency and Renewable Energy Savings:		Commercial/Industrial Energy Efficiency and Renewable Energy Savings:		Estimated Cumulative Savings Potential*	
$20,385,820		**$23,937,003**		**$45,322,824**	
$1,575	+	**$654**	=	**$1,367**	
per household		per job		per capita	

* Savings for residential and commercial/industrial energy efficiency are based on current average energy rates applied to projected energy reductions. Savings for residential and commercial/industrial renewable energy are based on an estimated 15 year ROI on solar installations with an average solar array design life of 30 years. See Appendix for Cumulative Potential Cost Savings Assumptions and data sources.

What You Can Do

You can support the goals of the Buildings and Energy section of the Northbrook Climate Action Plan as an individual, household, or a business. Here are just a few things you can do:

- Unplug 2 or more electricity "vampires" in your home or apartment. https://www.comed.com/News/Pages/NewsReleases/2019-10-30B.aspx
- Convert 3 or more lights or lamps to LED bulbs.
- Set your thermostat 2 or more degrees higher during cooling season, lower during heating season.
- Turn down your water heater to 120°.
- Replace an older home thermostat with a “smart,” programmable model.
- Replace a major appliance (e.g., refrigerator, air conditioner, furnace) with a newer, energy-efficient model.
- Replace a gas range or clothes dryer with an electric model.
- Schedule a home energy audit with a licensed contractor or ComEd. https://www.comed.com/WaysToSave/ForYourHome/Pages/SingleFamily.aspx
- Learn about adding solar panels to your home. Attend a free Midwest Renewable Energy Association information session, or schedule a solar suitability assessment of your home by a licensed contractor. https://www.growsolar.org/chicagoland/
- If you don’t own your home but support clean, renewable energy, sign up for community solar through ComEd. https://www.comed.com/SmartEnergy/MyGreenPowerConnection/Pages/CommunitySolar.aspx
- Install — or have a licensed contractor install — more insulation in your home.
- Install energy-efficient windows and doors, working with a licensed contractor.
- Install solar panels at your home, working with a licensed contractor. If possible, participate in Northbrook's residential solar group purchasing program.

Solid Waste
In Northbrook

4,276
tons of recycling in 2018

15,260
tons of organics/yard waste in 2018

9,708
tons of landfill waste in 2018

+111%
Change in total solid waste since 2010

Section 04
Waste Management

Click here to
return to TOC

Waste Management

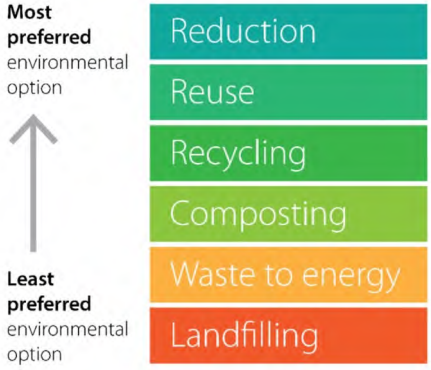
Why Waste Management Is Important

In Northbrook, solid waste contributed 4.1% of village-wide greenhouse gas emissions in 2018. Municipal solid waste sector has great potential to avoid emissions throughout the economy thanks to waste reduction and waste recovery. Landfills are the third largest anthropogenic (man-made) source of methane, accounting for approximately 11% of the estimated total global methane emissions.

Food discards and residuals that decompose in landfills release methane, a greenhouse gas that is at least 28 times more potent than carbon dioxide. This fact makes food wasting a significant contributor to solid waste greenhouse gas emissions. Habitat destruction, global warming, and resource depletion are some of the effects of our materials consumption.

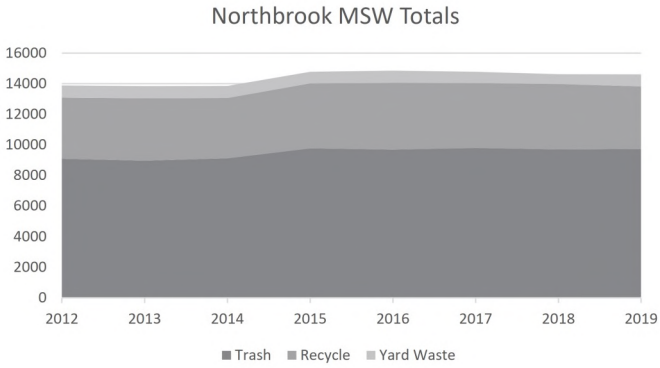
Waste Management Hierarchy

Important strategies to reducing our solid waste impacts on the environment include reduction, reuse, recycling, and composting.



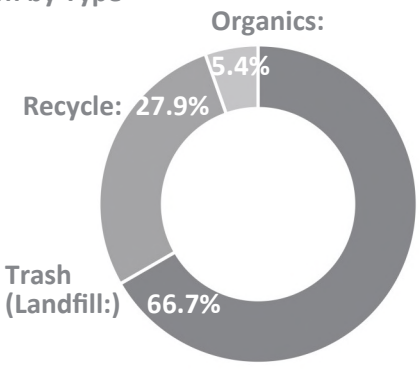
Northbrook Municipal Solid Waste (MSW) Handled

As shown on the Northbrook MSW Totals chart below, since 2012, the total municipal solid waste handled in Northbrook, including residential, commercial, and industrial waste collection, has increased from 13,880 tons to 14,613 tons. This represents a 5.3% increase in total solid waste handled—or a 7.2% increase when measured on a per capita basis.



As shown on the Northbrook MSW Breakdown by Type chart, the share of total residential, commercial, and industrial solid waste generated in the community has remained relatively consistent between yard waste, recyclables, and trash (landfill). In 2019, Organics collection was 5.4%, Recyclables 27.9% and trash (landfill) was the remaining 66.7% of the total solid waste handled.

MSW Breakdown by Type



Climate Change Considerations

Climate Impacts

This sector impacts climate change through combustion of fossil fuels in the collection and processing of materials, as well as the generation of methane from anaerobic decomposition of organic materials in landfills.

Opportunities

As indicated in the Waste Diversion Potential Estimate diagram, a significant portion of Northbrook's waste stream has the potential for being put to beneficial use while avoiding GHG emissions.

Climate Hazards

Hazards to the waste management system include damage to infrastructure from extreme weather and flooding.

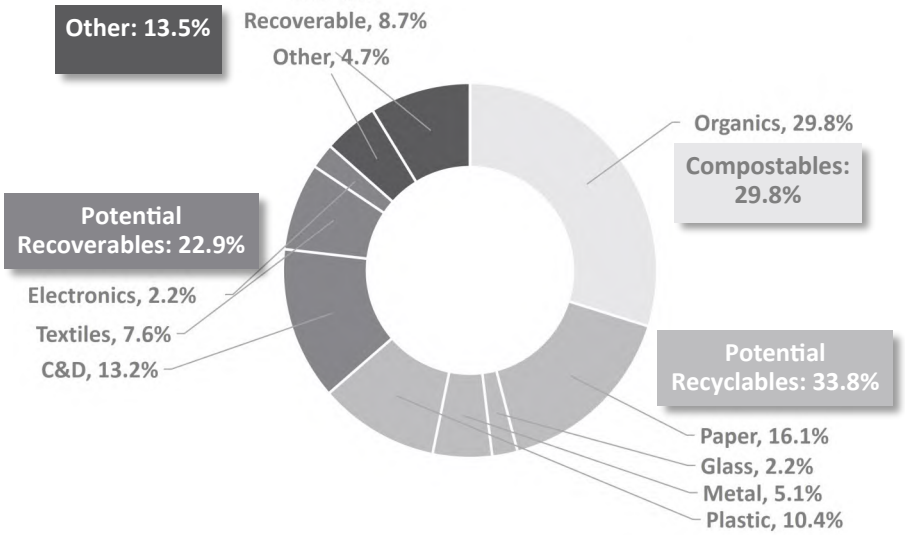
Northbrook Solid Waste Per Capita Trends

According to the 2015 Chicago Regional Greenhouse Gas Inventory compiled and issued by CMAP in 2018, the average total municipal solid waste handled per capita for suburban Cook County was 287.6 pounds annually. As shown in the Northbrook MSW Per Capita chart on the following page, the total municipal solid waste per capita for the Village was 827.4 pounds in 2012. By 2019, that number was 886.8 pounds—an increase of 5.3% and approximately 3 times the reported suburban Cook County average as reported by CMAP*. During this same timeframe, organics collection increased 1% and recycling increased 4% - when viewed within the total MSW handled, the combined organics and recycling share of municipal solid waste has fallen 3.4%. Meanwhile the trash (landfill) share of the total MSW has increased 9.1%. The total existing diversion rate (solid waste diverted from landfills) in Northbrook was 33.4% in 2019. This can be favorably compared to the total Cook County diversion rate of 30% as reported by Cook County in the 2018 Waste Management Plan.

*Note: The 2018 CMAP report indicates suburban Cook County per capita waste to be 287.6 pounds, however, the 2018 Cook County Waste Management Plan indicates countywide solid waste per capita to be 1,396 pounds. Although the CMAP number refers only to suburban Cook County and the Cook County number represents countywide waste, these numbers indicate a potential discrepancy.

Northbrook Solid Waste Characteristics

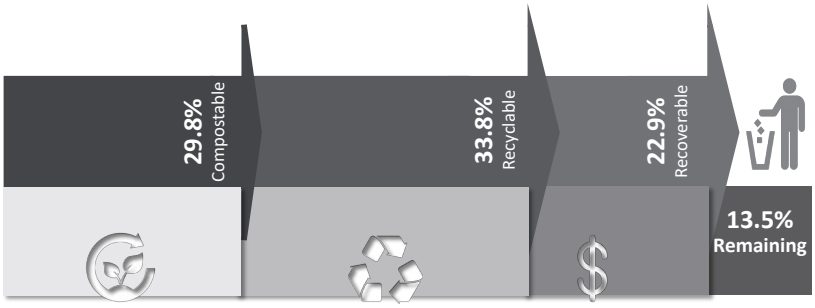
According to the 2018 Cook County Solid Waste Management Plan, Cook County Department of Environment and Sustainability commissioned a Commodity/Waste Generation and Characterization Study to determine the composition of different materials being landfilled. That study reviewed and characterized municipal solid waste (MSW) from both residential and industrial /commercial/ institutional (ICI) waste streams. To the right is the blended results of residential and commercial waste characteristics for Mt Prospect and Glenview as the two closest communities sampled in the study. This breakdown represents what is likely contained in the "trash" portion of the Northbrook MSW breakdown by type. This graph groups the classifications of waste defined in the study into broad categories based on their diversion potential including: Compostables, Potential Recyclables, Potential Recoverables, and Other.



Northbrook Waste Diversion Potential Estimate

Based on the blended waste characteristics, the diagram to the left illustrates the waste landfill diversion potential estimated based on the blended waste characteristics.

Estimated Diversion Potential: **86.5%**



Waste Management

Equity Considerations

- Accessibility to recycling and composting programs may not be equally and readily available to all community residents and may also be impacted by other participation-related barriers, including awareness of programs, user fees, accessibility based on housing type, and language barriers.
- Populations that are situated very close to the landfill or composting facility may experience nuisance issues like bad odors and potential health issues unless mitigation actions are implemented.

City-Wide Solid Waste Targets Supporting Sector Goals

Sector goals are established to both support the Village's Climate Action Plan in creating a climate resilient community and to reduce village-wide GHG emissions 35% below 2010 levels by 2030.

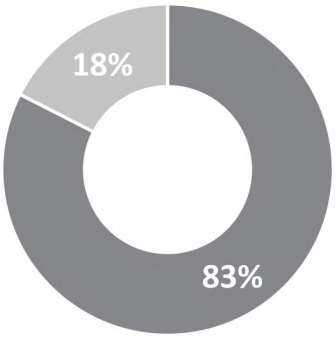
	Landfill Diversion	Total MSW Handled
Today (% of total waste)	33%	1,763 pounds per capita
2030 Targets (% of total waste)	**50%**	**1,675** pounds per capita

Strategies Supporting Sector Goals

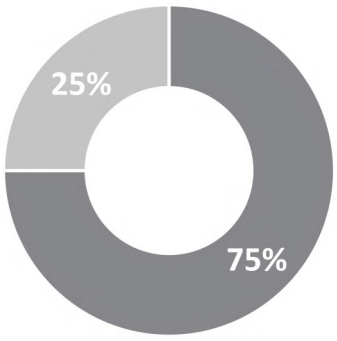
1. **Strategy WM 1:** Decrease total per capita municipal solid waste handled by 5% by 2030.
2. **Strategy WM 2:** Increase landfill waste diversion to 50% by 2030.
3. **Strategy WM 3:** Increase organics diversion from landfill.
4. **Strategy WM 4:** Increase recycling rate.
5. **Strategy WM 5:** Educate, engage, and empower the public to meet waste management goals.

Community Survey Responses Supporting Actions in Sector

Should multi-family and apartment complexes be required to offer recycling for residents?



Would you support the Village providing incentives to help divert or recycle construction materials?



Waste Management

1 Strategy WM 1:
Decrease total per capita municipal solid waste handled by 5% by 2030.

	Actions	Implementation Phase
WM 1-1	Phase out single-use products by 2026 by implementing an opt-in fee for such products. This would apply to (but not limited to) bags (both paper and plastic), utensils, napkins, and take-out containers. Explore the feasibility of establishing a reusable takeout container service. Applies to businesses of any size. Encourage restaurants to allow customers to bring their own take-out containers	1
WM 1-2	Encourage businesses of all sizes to utilize technology and software when determining purchasing product needs to reduce overhead waste, specifically for food waste in restaurants and grocery or specialty food stores.	1
WM 1-3	Develop and then adopt an ordinance requiring reusables for dine-in restaurants and sustainable take-out food ware. This effort would reduce a significant source of single-use plastics and other high-carbon materials used in the Village.	2
WM 1-4	Encourage reduction of single-use products and limit packaging by 2026 at point of sale. This would apply to (but not limited to) bags (both paper and plastic), Styrofoam trays, cling wrap, plastic net bags, to-go containers, and boxes. Encourage businesses to avoid pre-packaging products. Applies to businesses of any size	2

2 Strategy WM 2:
Increase landfill waste diversion to 50% by 2030 (a 51% increase over 2019 diversion levels).

	Actions	Implementation Phase
WM 2-1	Conduct a waste audit to determine waste diversion opportunities. Establish a Village Facility Zero Waste goal to eliminate landfill stream from office operations. Encourage other public agencies (schools, park district, library etc) and businesses.	1
WM 2-2	Establish a zero waste Village Event policy making zero waste office operations and events standard.	1
WM 2-3	Reduce construction and demolition waste by ensuring that strong recycling and reuse requirements are met for all building-related permits Village-wide. Require compliance with Cook County's construction and demolition requirements including waste management plans; provide support resources. Partner with Habitat, reuse	1
WM 2-4	Require that all real estate developments that receive financial assistance or special zoning approval from the Village agree to exceed the Village's sustainability goal for waste diversion for 2030	1
WM 2-5	Assure that Cook County enforces its Construction & Demolition Debris Diversion Ordinance, and encourage contractors to exceed minimum requirements. Provide a copy of the ordinance and requirements with Village permit materials.	2

2 Strategy WM 2:
Increase landfill waste diversion to 50% by 2030 (a 51% increase over 2019 diversion levels). (continued)

	Actions	Implementation Phase
WM 2-6	Restructure solid waste rates to incentivize smaller landfill bins and quantities and larger recycling and compost bins.	2
WM 2-7	Establish a Waste Ordinance, requiring all residential, multi-family residential, and commercial property owners to offer recycling and compost collection services. Example policy: https://bouldercolorado.gov/zero-waste/universal-zero-waste-ordinance with the long term goal of complying with the zero waste initiative	2

3 Strategy WM 3:
Increase organics diversion from landfill.

	Actions	Implementation Phase
WM 3-1	Conduct an organics waste collection pilot project with a sample of Village businesses to test the interest, methodology, and amount of commercial food waste that would need to be accommodated by a commercial organics collection program. Explore possible incentives for food retailers, restaurants, and institutions to participate in food waste reuse and recycling programs	1
WM 3-2	Manage Food Waste: Expand on existing programs and coordinate with other entities to reduce food waste. Unused food should be funneled to composting or donation as much as possible.	1
WM 3-3	Establish a communication campaign to promote and increase the utilization of the curbside compost collection program to all residential properties (e.g., single-family and multifamily) for yard waste, food waste and certified compostable products.	2
WM 3-4	Collaborate with residential and commercial organics haulers to establish organics diversion programs for residential and commercial buildings. Explore options such as trash Integrated Food Scrap Compost Collection (see Ramsey County MN pilot program)	2
WM 3-5	Combat food waste by encouraging retailers and restaurants to donate, reduce, reuse, or compost their unsold food, creating “zero-waste sections” where products are sold close to their expiration dates, and designating “zero-waste coaches” to raise awareness among staff and help manage products reaching the end of their marketable life. Edible unsold products shall be donated. When not edible, organic waste shall be composted through a Village-approved vendor.	2

4 Strategy WM 4:
Increase recycling rate.

	Actions	Implementation Phase
WM 4-1	Increase waste diversion opportunities by increasing recycling and organics collection bins in public places	1
WM 4-2	Develop and fund an assistance program for businesses to provide waste audit services, support businesses in establishing tracking and reporting waste streams, identify reduction, diversion, and beneficial use opportunities. Program should include identification of potential grants and other revenue sources for implementation costs. Assistance program should pro-actively identify and outreach to businesses likely to benefit from waste reduction assistance. Assistance should include connecting businesses with energy audit and other resources in support of full CAP goals. Identify collaborative partners such as the County and recycling and organics haulers. Goal: 12 business waste audits completed with recommendations implemented annually.	2
WM 4-3	Develop program to recycle single-use styrofoam items, possibly in cooperation with Village waste disposal vendor and SWANCC.	2

5 Strategy WM 5:
Educate, engage, and empower the public to meet waste management goals.

	Actions	Implementation Phase
WM 5-1	Support state legislation to prohibit Styrofoam ; incentivize restaurants to choose alternatives ; education campaigns on single use items and consumer choice	1
WM 5-2	Educate the community on waste management strategies. Introduce the term Zero Waste and lifecycle concepts. Include reducing consumption, followed by reusing, repurposing, recycling, and composting. Include clear information on what can and cannot be recycled. Offer tips such as opting out of junk mail, etc.	1
WM 5-3	Support collaborative consumption community projects, such as neighborhood compost projects, tool libraries, and repair cafes through mini-grant programs	1
WM 5-4	Provide outreach and education to Village businesses in reducing greenhouse gas emissions through their supply chains	2
WM 5-5	Encourage Northbrook residents to participate in organics collection through creation of “Include the Food” education campaign.	2
WM 5-6	Conduct a literature review of waste incentive/disincentive programs for the community and businesses that have been successfully implemented in other cities	2

Waste Management

Planned Waste Management GHG Emission Reductions

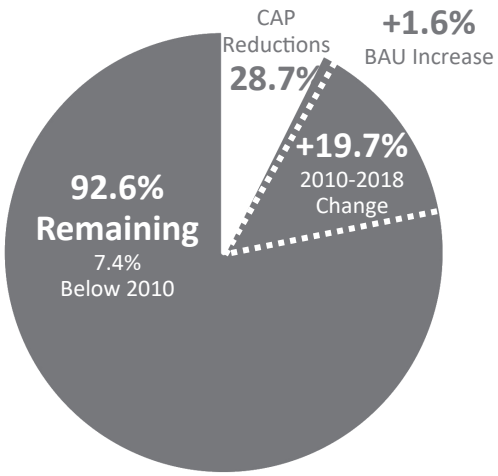
Planned Sector Emission Reductions Through 2030

The strategies and actions included in this section of the Climate Action Plan are projected to reduce the Village's annual GHG emissions by 5,090 metric tons (MT) by 2030 - a 28.7% reduction over 2010 levels. Changes in business-as-usual impacts over the same period, however, are anticipated to *increase* 282 metric tons and previous changes between 2010 and 2018 increased emissions in this sector by 3,500 metric tons. The result is a total community wide Waste Manageent sector reduction of 7.4% when compared to 2010 levels.

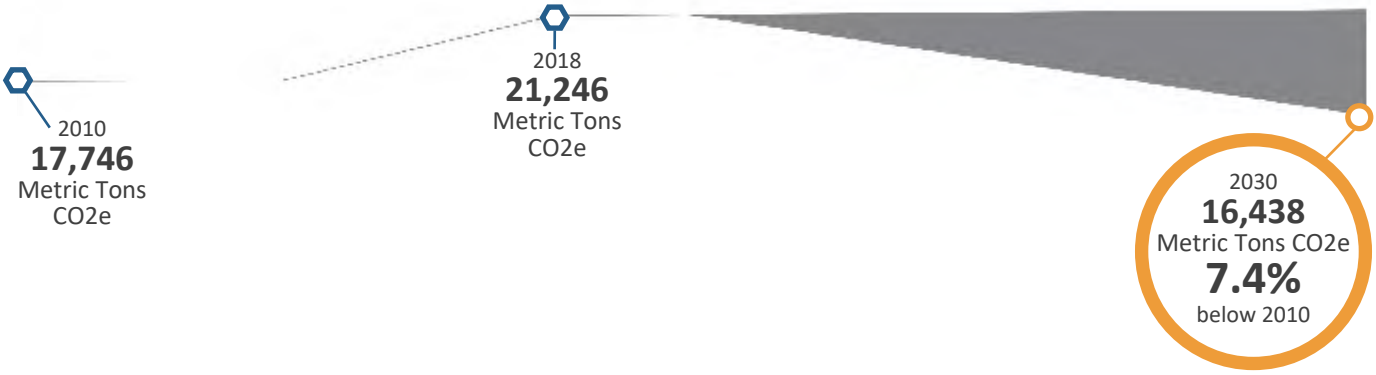
When compared to 2010 emissions, this is equivalent to eliminating **22.6 million** cubic feet of man-made greenhouse gas atmosphere annually by 2030

Sector Emissions Reduction below 2010 by 2030

The total change to sector emissions include CAP Plan reductions, BAU emission changes, and previous changes between 2010 and 2018 as follows:



Northbrook's Waste Management Carbon Reduction Pathway



Estimated Cumulative Economic Savings

Implementing many of the measures in this plan, such as reduction of food waste, material waste, and overall consumption, can save money for the community. The estimated community savings of the goals for this section include

Organics/Food Waste Diversion Savings:		Commercial/Industrial Waste Reduction Savings:		Estimated Cumulative Savings Potential
$44,618,218	+	$313,500	=	$44,931,718
$1,345 per capita		$8 per job		$1,355 per capita

*Savings for organics/food waste diversion are based on multiplying the estimated pounds of food waste reduced by an estimated value per pound based on "A Roadmap to Reduce US Food Waste" by ReFED. Savings for commercial waste reduction are calculated based on multiplying the estimated number of participating organizations by the average savings per company reported by the MN WasteWise program (a similar initiative). See Appendix for Cumulative Potential Cost Savings Assumptions and data sources.

What You Can Do

You can support the goals of the Waste Management section of the Northbrook Climate Action Plan as an individual, household, or a business. Here are just a few things you can do:

- How much of your waste can you divert to recycling? Challenge yourself and your household to increase your recycling. Make sure to rinse and dry your recyclables; dirty materials contaminate the process and have to be landfilled.
- Carry groceries and other purchases in reusable bags. Remember to bring your bags to the grocery store, farmer's market, and when you go retail shopping.
- Give up single-use plastics by switching to sturdy, reusable items like metal/hard plastic water bottles, cutlery, & to-go containers.
- Choose items with no packaging, minimal packaging, or packaging that is compostable or completely recyclable.
- Give unused clothes and household items (in good condition) to a local nonprofit, neighbor or friend.
- Shop local second-hand and vintage stores.
- Create a composting bin and routine.
- Challenge yourself and your household to eliminate your food waste. Minimize your food waste by first eating what you already have in your fridge. Meal planning and making grocery lists can also reduce your food waste. https://www.epa.gov/recycle/reducing-wasted-food-home.

Water + Wastewater
In Northbrook

1.3 billion
gallons of water consumed in 2018

1.2 billion
gallons of wastewater generated in 2018

266
Community flooding events reported in Cook County since 2001

-18%
Change in total solid waste since 2010

Section 05 **Water + Wastewater**

Click here to return to TOC

Water and Wastewater

Why Water and Wastewater is Important

Water is at the core of climate change and sustainable development. Quality water is vitally important for socio-economic development, maintaining healthy ecosystems, and for human survival. Water is central to the production and preservation of a wide range of services benefiting people. How we process water is also linked to our greenhouse gas emissions. Water related energy use totals 13% of US electricity consumption and has a carbon footprint of at least 290 million metric tons. Meanwhile, wastewater treatment is responsible for 3% of global GHG emissions.

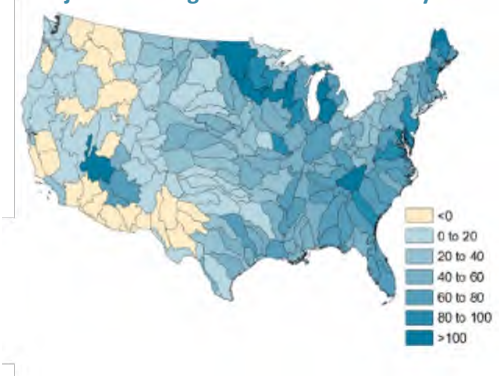
Water is also at the heart of adaptation to climate change. In our region/the Midwest, climate change will increase the likelihood of drought combined with additional heavy rain events, flooding, and flash flooding. Climate change will also/result in increased stress on our water systems, increase water pollution potential, and place more risk on maintaining safe water resources. Water is an irreplaceable, critically important resource fundamental to the well-being of our communities. Water can only be considered renewable with high quality best water management practices in place.

According to FloodFactor, 10% of all properties, approximately 1,216 locations, are at risk for flooding. By 2050 the number will increase to 1,232 properties due to climate change impacts. (https://floodfactor.com/city/northbrook-illinois/1753481_fsid)

Regional Water Stress

By 2025, an estimated 1.8 billion people will live in areas plagued by water scarcity, with two-thirds of the world's population living in water-stressed regions. Since 1985, water yield in parts of Illinois, Iowa, Wisconsin, and Minnesota have declined as much as 20%. Projected climate changes will not only continue the water yield decreases but also increase water demand - by 2030 communities throughout the Midwest are projected to have an increase in annual water demand of 4-6% due to climate change and population increases. By 2071, nearly half of the 204 fresh water basins in the United States may not be able to meet the monthly water demand. (Sources: “Adaptation to Future Water Shortages in the United States Caused by Population Growth and Climate Change”, “Managing the water–electricity demand nexus in a warming climate”).

Projected Change in Water Demand by 2050



Climate Change Considerations

Climate Impacts

This sector impacts climate change through fossil fuel use to generate the electricity required to process and distribute water.

Climate Hazards

Hazards to the water and wastewater system include damage to infrastructure from extreme weather and flooding. Village-wide hazards include increased flooding and flash flooding potential.

Water and Wastewater

Equity Considerations

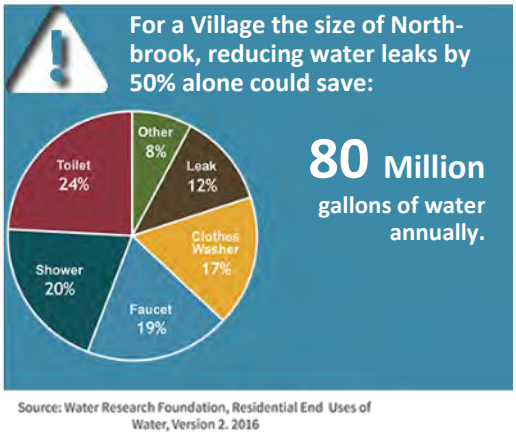
- Low-income neighborhoods frequently suffer more damage from flooding, according to studies by the National Academies of Sciences, Engineering and Medicine (*Framing the Challenge of Urban Flooding in the United States*, 2019). The frequency and magnitude of heavy rain events is expected to increase as a result of a changing climate, making the future flooding impacts for at-risk neighborhoods potentially more acute.
- Disadvantaged communities within cities often have denser populations, more impervious surfaces, and less open/green spaces. These areas can also be prone to flooding and sewer overflows. Stormwater management through the creation of open, green spaces serve to revitalize and promote health within these disadvantaged communities.

Sector Goals

Sector goals are established to both support the Village's Climate Action Plan in creating a climate resilient community and to reduce village-wide GHG emissions 35% below 2010 levels by 2030.

Potable Water Consumption

Today	1,267 Million Gallons
2030 Targets	1,172 Million Gallons



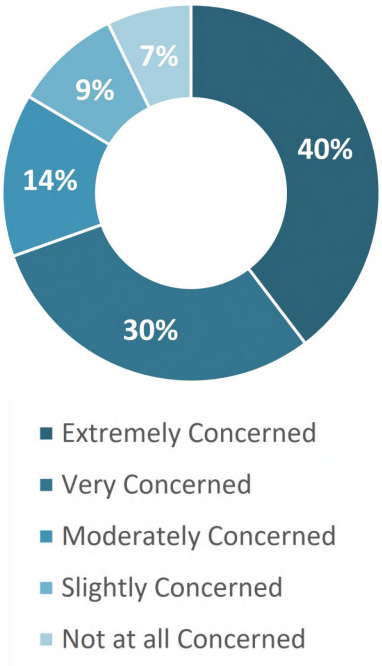
Source: Water Research Foundation, Residential End Uses of Water, Version 2. 2016

Strategies Supporting Sector Goals

1. **Strategy WW 1:** Promote increased water conservation Village Wide with a targeted reduction of 7.5% by 2030.
2. **Strategy WW 2:** Mitigate the projected increased flood hazards and impacts due to climate change.
3. **Strategy WW 3:** Update design standards and plans to meet projected climate change flood mitigation requirements.
4. **Strategy WW 4:** Increase stream, river and wetland protection and restoration.

Community Survey Responses Supporting Actions in Sector

How concerned are you about the possible infrastructure and ecosystem impacts of climate change caused flooding?



Water and Wastewater

1 Strategy WW 1:

Promote increased water conservation Village Wide with a targeted reduction of 7.5% by 2030.

	Actions	Implementation Phase
WW 1-1	Update Village wide landscaping guidelines for reducing water consumption and chemical use	1
WW 1-2	Reduce landscaping water use by encouraging water-efficient irrigation systems, grass replacement, and planting native and drought-resistant trees and vegetation	1
WW 1-3	Evaluate the potential for installation of rainwater collection systems at Village facilities for graywater uses, and investigate opportunities for graywater reuse at existing and new Village facilities and properties	1
WW 1-4	Expand water conservation programs that focus on outdoor irrigation, which may also support better identification of water-related carbon sequestering opportunities such as using soil amendments, native grasses and proper tree watering and consider requiring them during the permitting process	2
WW 1-5	Establish an ordinance requiring moisture sensors with all new irrigation systems installed in the village.	2
WW 1-6	Facilitate reduction of water use by top 20 customers annually. Assist large institutions and businesses in identify specific opportunities for employees or customers to conserve water and incorporate water efficiency into internal operations	2

2 Strategy WW 2:

Mitigate the projected increased flood hazards and impacts due to climate change.

	Actions	Implementation Phase
WW 2-1	Prioritize managing stormwater before it enters the sewer system through a combination of overland flow, detention, and infiltration strategies (for example, permeable surfaces)	1
WW 2-2	Prepare a Blue Spot flash flood risk map to identify areas within Village that are particularly vulnerable to flash flood impacts. Create and implement a mitigation and response plan. Share and promote the information developed by the flash flood risk map, particularly among vulnerable populations and neighborhoods. (https://climate-adapt.eea.europa.eu/metadata/tools/the-blue-spot-model-a-key-tool-in-assessing-flood-risks-for-the-climate-adaptation-of-national-roads-and-highway-systems)	1
WW 2-3	Adopt policies to incentivize building owners and developers to explore revegetation, tree preservation planting and maintenance, de-paving and porous pavement, green infrastructure like bioswales and Eco-roofs and site development performance standards.	2

3 Strategy WW 3:

Update design standards and plans to meet projected climate change flood mitigation requirements.

	Actions	Implementation Phase
WW 3-1	Conduct a stormwater management study exploring full range of methods of storm-water management including permeable pavements, bioswales, rain gardens, bio-char amendments in soils with high clay content, and flood-tolerant plantings. Establish a recommended percentage goal of stormwater from Village-controlled impervious surfaces with sustainable stormwater strategies by 2030. Findings of study to be integrated into updated Village Master Stormwater Management Plan with recommended implementation projects.	1
WW 3-2	Pilot pervious pavement test section in an appropriate public area (e.g. sidewalks, parking lots).	2
WW 3-3	Reduce or offset impervious surfaces where possible, and use lighter colored pavements and building materials to lessen the impact of urban heat island effect.	2

4 Strategy WW 4:

Increase stream, river and wetland protection and restoration.

	Actions	Implementation Phase
WW 4-1	Coordinate with local watershed groups, Conservation District, State and federal agencies for restoration, education and outreach	1
WW 4-2	Identify and catalog current efforts underway across the community to increase stream, wetland, and river restoration	2

Water and Wastewater

Planned Water and Wastewater GHG Emission Reductions

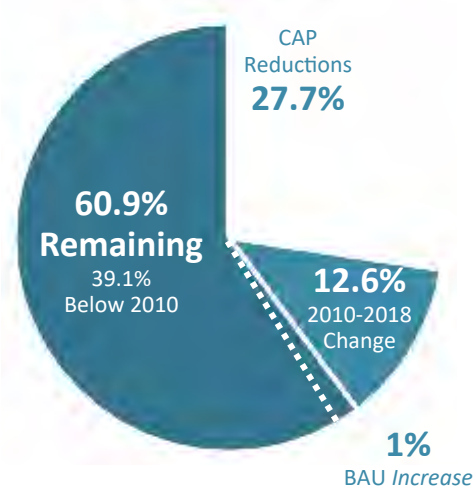
Planned Sector Emission Reductions Through 2030

The strategies and actions included in this section of the Climate Action Plan are projected to reduce the Village's annual GHG emissions by 708 metric tons (MT) by 2030 - an 27.7% reduction over 2010 levels. Changes in business-as-usual impacts over the same period are anticipated to *increase* emissions by 30 metric tons and previous changes between 2010 and 2018 decreased emissions in this sector by 321 metric tons. The result is a total community wide Water and Wastewater sector reduction of 39.1% over 2010 levels.

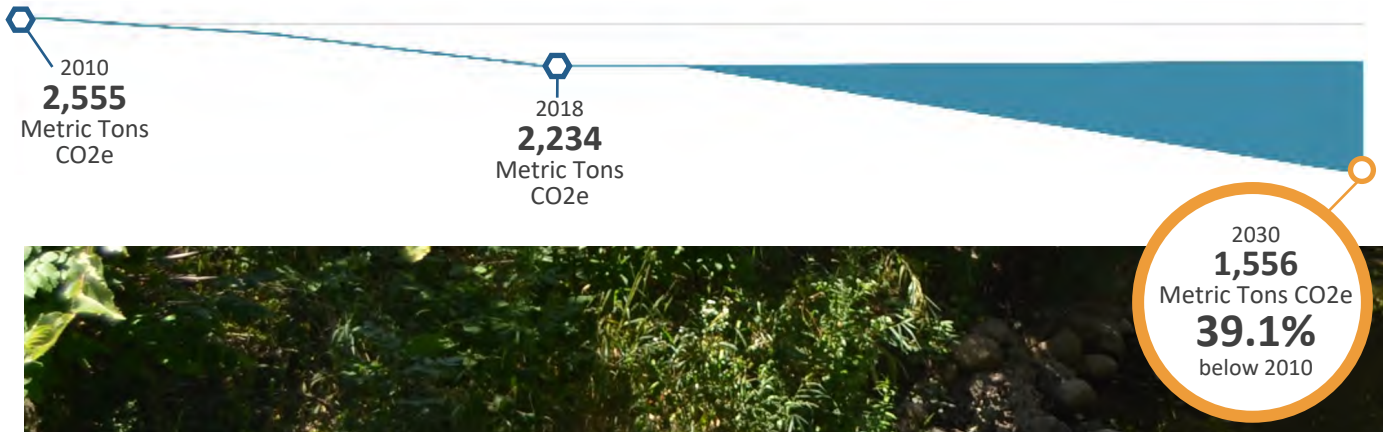
When compared to 2010 emissions, this is equivalent to eliminating **19.6 million** cubic feet of man-made greenhouse gas atmosphere annually by 2030.

Sector Emissions Reduction below 2010 by 2030

The total change to sector emissions include CAP Plan reductions, BAU emission changes, and previous changes between 2010 and 2018 as follows:



Northbrook's Water and Wastewater Carbon Reduction Pathway

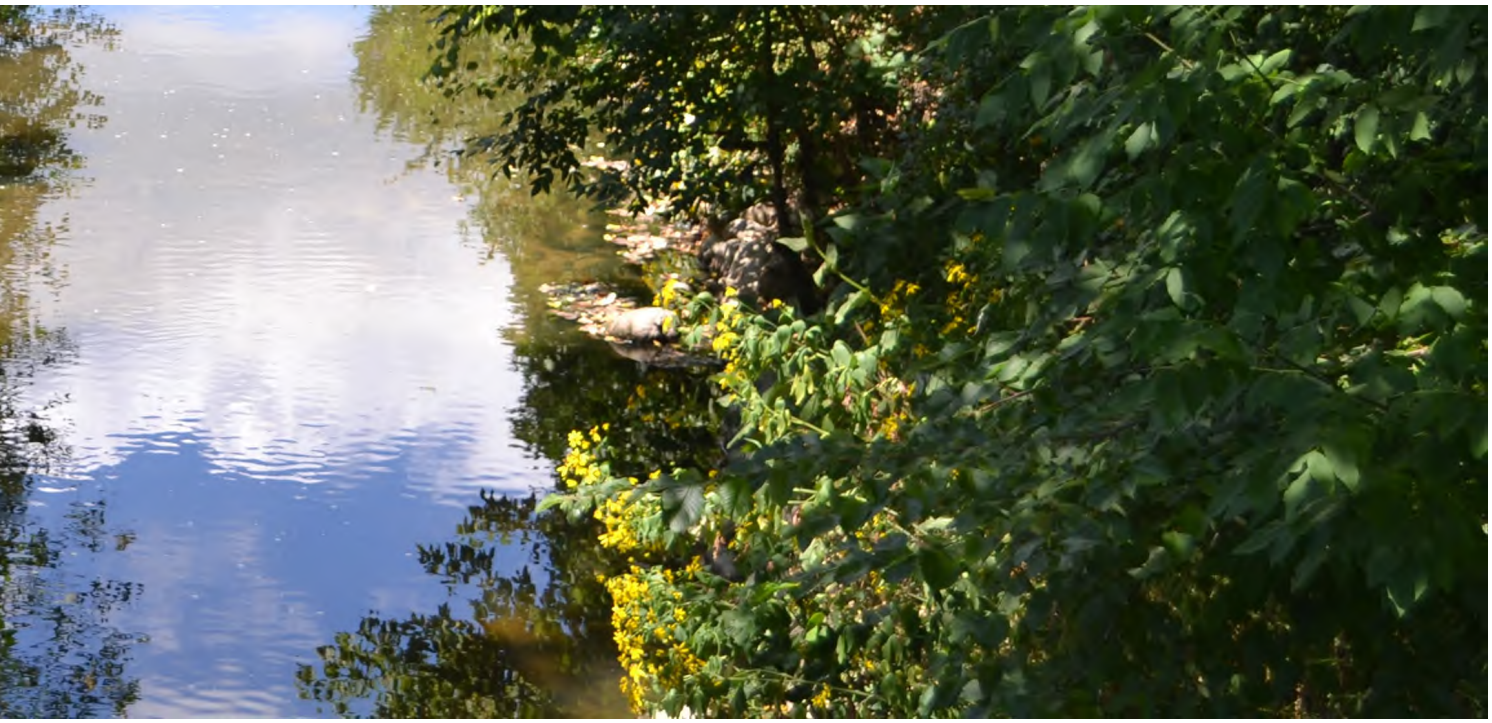


Water and Wastewater

What You Can Do

You can support the goals of the Water and Wastewater section of the Northbrook Climate Action Plan as an individual, household, or a business. Here are just a few things you can do:

- Turn off the faucet while brushing your teeth.
- If you have dishwasher, use it. Research shows we use more water washing dishes by hand than running a full or nearly full dishwasher.
- Replace your lawn or portions of your lawn with drought resistant native plantings, prairie grasses, and wild flowers and eliminate or greatly reduce exterior watering.
- If you have a lawn and garden irrigation system, or use hoses and sprinklers, water thoroughly less often, and do so in the early morning or evening.
- Collect rainwater and use it for indoor and outdoor plants.
- Install — or have a licensed plumber install — water-saving aerators on 2 or more showerheads and faucets.
- Install — or have a licensed plumber install — a water-saving low-flow toilet.



Local Food
In Northbrook

5
Community gardens

1
Farmers market

12.6%
Food insecurity in Cook County

Section 06
Local Food + Agriculture

Click here to
return to TOC

Local Food and Agriculture

Why Local Food and Agriculture Are Important

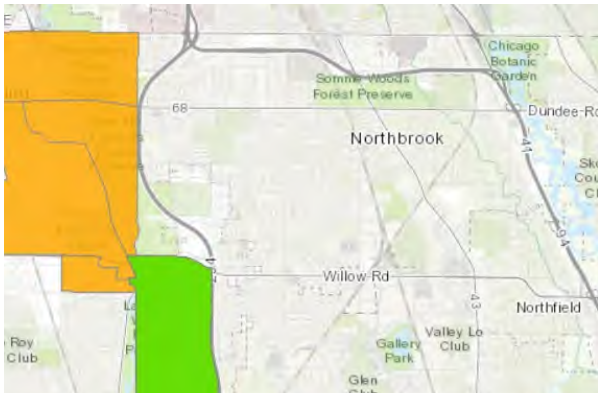
Food and climate change are directly linked. For nutritionally insecure people, climate change is a threat multiplier. Extreme weather events, extreme temperature variations, changes in precipitation, changing soil temperatures and other climate impacts will affect crop yields. Climate impacts can also introduce interruptions in the current food processing and distribution system. Disruptions that occur in the food system are likely to cause food availability or pricing fluctuations.

Our choices about what we eat and where our food comes from also directly impact our personal and community greenhouse gas emissions. Transporting food across long distances burns fossil fuels and emits greenhouse gases. In addition, the extended period of time of long-distance transport increases the need for refrigeration. The less transportation and refrigeration needed to supply us our food, the more sustainable it becomes.

Strengthening local food sources can address both climate change relationships with food and also supports your small business local economy. Studies have indicated that nearly 32 jobs are created for every $1 million in revenue generated by produce farms involved in a local food market, compared to only 10.5 jobs for those involved in wholesale channels exclusively. Increased local food systems also increase community resilience. A robust local food system establishes additional supply chains and resilience to distribution disruptions. Healthy local food systems can also play a critical role in addressing food access vulnerability and food insecurity within neighborhoods of higher vulnerability. Increased local food systems also tend to increase diversity and long-term food system resilience in food crops cultivated.

Map of Vulnerable Population Distribution Within Community Food Access

On the map to the left, highlighted sections represent low-income census tracts at least 500 people or 33 % of residents are more than 1 mile (green sections) or 1/2 mile (orange) from the nearest supermarket (defined as a store containing all the major food departments necessary to provide full nutrition to a household) . None of the census tracts within Northbrook are identified as regions with significant populations with food access concerns. It should be noted, however, that portions of the population may have food insecurity which could be identified through a community wide food security assessment.



Climate Change Considerations

Climate Hazards

Hazards to the local food and agriculture system include reduced crop quality and yield, vulnerability to pests and soil moisture as well as fluctuation in availability, food price volatility and change.

Opportunities

Increased capacity of local food and agriculture systems and improved farm-to-table approaches can reduce community food insecurity while creating local jobs and improved community resilience.

Local Food and Agriculture

Equity Considerations

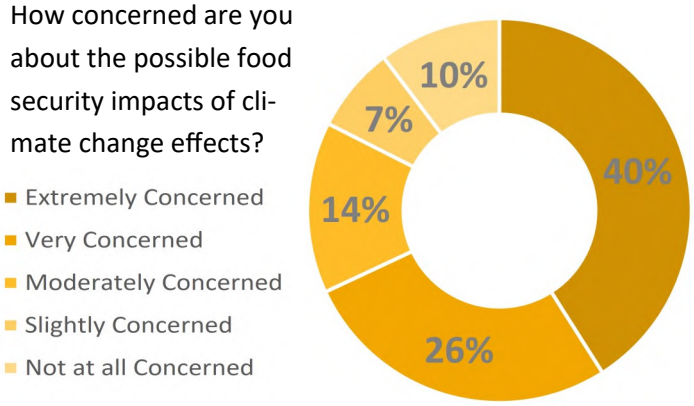
- People in low-income neighborhoods may have limited access to full-service supermarkets or grocery stores - an area known as a "food desert."
- Studies have also shown that communities with fewer resources often have more outlets that promote unhealthy dietary behaviors such as fast food restaurants, and little access to affordable nutritious food. This condition is known as a "nutrition desert."

Strategies Supporting Sector Goals

1. **Strategy LF 1:** Increase production of local food, particularly serving low income and food insecure individuals.
2. **Strategy LF 2:** Increase access and inter-
3. **Strategy LF 3:** Reduce food waste and
4. **Strategy LF 4:** Improve local food resili-

Community Survey Responses Supporting Actions in Sector

How concerned are you about the possible food security impacts of climate change effects?



Strategy LF 1:

Increase production of local food, particularly serving low income and food insecure individuals.

	Actions	Implementation Phase
LF 1-1	Identify, map and prioritize food insecure areas and populations.	1
LF 1-2	Promote and expand public education campaigns to encourage purchasing and procuring locally grown and produced food at the individual and institutional level	1
LF 1-3	Promote local food production, sales, and consumption and review Village codes to remove barriers for urban farming including innovative solutions such as aquaponics, hydroponics, indoor agriculture, vertical farms	1
LF 1-4	Establish a public Food Forest by adding edible trees, shrubs, and planting regionally native vegetables to existing public landscaping. Select an existing property for a pilot project. (https://projectfoodforest.org/)	2
LF 1-5	Create "edible walk to school" routes by planting fruit trees, shrubs, and perennials (apple, pears, plums, blueberries, strawberries, service berries, etc.) that eventually will allow students walking to school to pick fruit off the trees. Explore partnerships including Organic Gardener and Illinois Extension Cook County Master Gardeners.	2
LF 1-6	Establish local agriculture ordinances clarifying the allowance of local food production activities such as front yard vegetable gardening, community gardens, urban farming, beekeeping, poultry keeping, etc.	2

Local Food and Agriculture

2 Strategy LF 2:
Increase access to and interconnect all community gardening.

	Actions	Implementation Phase
LF 2-1	Establish a communication system whereby local gardeners could trade food (i.e. if one person has too many tomatoes, could offer them to trade or for free pick up).	1
LF 2-2	Establish "Grow Northbrook" central community food plot/garden, a visionary project supported by the Village that trains kids and residents from the community in local food growth. Include all stages: carpentry, irrigation, running a business. Village designs program with local business, Organic Gardener. Have a main garden and also satellite gardens; Bring in students, community volunteers. Include a training class through high school for students and/or through library for residents. Make an infrastructure investment in Village. Link it with Library and Park district. Provides food and a good message and learning opportunity. Possibly work with local restaurants who can use food. Or look into donating food (or some of the food). Look into including microgreens that can be grown all year indoors. Examples: https://edibleevanston.org/ https://www.burnsvillemn.gov/grow	1
LF 2-3	Allow community gardens on vacant land in all zoning districts except industrial to increase the availability of locally produced food for all residents.	2
LF 2-4	Promote year-round farmers markets.	2

3 Strategy LF 3:
Reduce food waste and hunger.

	Actions	Implementation Phase
LF 3-1	Work regionally to support and facilitate food donation programs. Food donation programs reduce the amount of healthy, safe food that goes to waste and redirects it to those in need.	1
LF 3-2	Support edible food donation through coordination with the food bank and donations from Village and community partner events	1

Local Food and Agriculture

4 Strategy LF 4:
Improve local food resilience and availability.

	Actions	Implementation Phase
LF 4- 1	Increase availability of composting options for residents and businesses such as expanded curbside organics collection, back-yard composting, workplace composting, and organics-to-compost partnerships with community gardens. Include a focus on options which support local gardening and food production.	1
LF 4- 2	Offer low price compost bins similar to rain barrels the Village currently offers; potentially work with businesses as well and Village could then sell or give compost to residents	1
LF 4- 3	Incentivize and reward soil best management practice for urban lawns, gardens, landscaping, parks, open spaces, prairies, environmentally sensitive areas, and agricultural land uses	2

What You Can Do

You can support the goals of the Local Food and Agriculture section of the Northbrook Climate Action Plan as an individual, household, or a business. Here are just a few things you can do:

- Rent a plot at your local community gardens and grow your own.
- Eat a plant-rich diet. Animal products are extremely GHG-intensive to produce compared to plants. Eating less meat and dairy will reduce emissions associated with food consumption. Eating regionally-grown food that is suitable for the Illinois climate will also make a difference through reduced transportation-related emissions. A great place to start is with “Meatless Mondays” or one meat-free meal a day. https://ourworldindata.org/food-choice-vs-eating-local
- Buy food directly from a local grower on an ongoing basis by joining a Community Sponsored Agriculture (CSA) group or frequenting the farmer’s market.
- Plant fruit or nut bearing trees or shrubs that are well suited for our hardiness zone on your property. Examples include: Trees: Persimmon, Paw-paw, Black walnut, Shrub: Serviceberry.
- Support restaurants and grocery stores that use and sell locally-grown food.
- Buy food that is in season, minimizing the distance food must travel.
- Support your local farmers markets.
- Buy ethically grown and harvested food, like fair-trade coffee and chocolate.

Climate Health + Safety

In Northbrook

1,216
Properties with significant risk of flooding

+4-6°F
Increase in temperature by 2050

+70% more
Air conditioning demand by 2050

+20-25 days
Longer allergy season by 2050

Section 07
Health and Safety

Click here to return to TOC

Health and Safety

Why Health and Safety Are Important

There is a strong relationship between human health and environmental health. From the air we breathe to the water we drink and use, life here on Earth depends on the natural resources and the environment around us. This link between the environment and human health is a critical consideration of the impacts of climate change. As outlined in the Village's Climate Risk and Vulnerability Assessment, changes in climate, such as higher average temperatures and increased storm frequency and intensity, can intensify public health stressors. These climate change impacts endanger public health and safety by affecting the air we breathe, the weather we experience, our food and water sources, and our interactions with the built and natural environments. As the climate continues to change, the risks to human health continue to grow.

The health of our environment affects our public health, and agencies should promote it as such. There is a direct relationship between climate action and community health because the health of our environment affects public health.

Equity Considerations—Vulnerable Populations

Climate change impacts the health of all community members, however, people within our communities are differently exposed to hazards and some are disproportionately affected by the risks of climate change. According to the National Climate Assessment, greater health risks related to climate impacts can be experienced by some populations in our communities including children, older adults, low-income communities, and some communities of color. Others, like children, older adults, low-income communities, some communities of color, and those experiencing discrimination are disproportionately affected by extreme heat and weather events, and many have increased health and social vulnerability which decreases their access to resources that can help them avoid the risks of climate change.

According to the National Climate Assessment (https://nca2018.globalchange.gov/chapter/14/):

> Additional populations with increased health and social vulnerability typically have less access to information, resources, institutions, and other factors to prepare for and avoid the health risks of climate change. Some of these communities include poor people in high-income regions, minority groups, women, pregnant women, those experiencing discrimination, children under five, persons with physical and mental illness, persons with physical and cognitive disabilities, the homeless, those living alone, Indigenous people, people displaced because of weather and climate, the socially isolated, poorly planned communities, the disenfranchised, those with less access to healthcare, the uninsured and underinsured, those living in inadequate housing, and those with limited financial resources to rebound from disasters.

Climate Change Considerations

Climate Hazards

Climate stressors include increases in the frequency and intensity of poor air quality days, extreme high temperature events, heavy rainfalls, extended pollen seasons, changed distribution of disease carrying pests.

Opportunities

Strategies which improve community connectedness, mobility, community resilience through healthy lifestyles frequently coincide with climate mitigation measures such as improved pedestrian safety and low income home weatherization.

Health and Safety

Northbrook Vulnerable Populations Risk Sensitivity Chart

The following identification of Northbrook population climate vulnerabilities is excerpted from the Northbrook Climate Vulnerability Assessment.

		Primary Risks to The Population								Enhanced Vulnerabilities				
	Population	Extreme Weather / Temp	Flood	Air Quality	Vector-Borne	Food Insecurity	Water Quality	Waterborne	Power Failure	Crop Yield	Mortality	Energy Costs	Property Crime	Violent Crime
children	2,869	2,869		2,869	2,869	2,869		2,869	2,869	2,869	2,869	2,869		
seniors	14,442	14,442	14,442	14,442	14,442	14,442			14,442	14,442	14,442	14,442	14,442	
disabled	5,363	5,363	5,363	5,363		5,363			5,363		5,363	5,363	5,363	
Est Total Low Income	6,163	6,163	6,163	6,163	6,163	6,163	6,163	6,163	6,163	6,163		6,163	6,163	6,163
POC	10,021	10,021	10,021	10,021	10,021	10,021	10,021	10,021	10,021			10,021	10,021	10,021
Limited English	3,084	3,084	3,084	3,084	3,084	3,084		3,084	3,084	3,084		3,084	3,084	3,084
Composit At-Risk Workers	2,237	2,237	2,237	2,237	2,237			2,237						2,237
No Vehicle Access	3,607	3,607	3,607	3,607		3,607			3,607	3,607				
Total by category		47,786	44,917	47,786	38,816	45,549	16,184	24,374	45,549	30,165	22,674	41,942	39,073	21,505
percentage of Vuln pop		100.0%	94.0%	100.0%	81.2%	95.3%	33.9%	51.0%	95.3%	63.1%	47.4%	87.8%	81.8%	45.0%
Rank by Vuln		1	2	1	3	2	6	4	2	4	5	2	3	5
Percentage of Tot Pop		87.9%	82.6%	87.9%	71.4%	83.8%	29.8%	44.8%	83.8%	55.5%	41.7%	77.1%	71.9%	39.6%

Based on the total estimated population count for each vulnerable population and considering the risks each demographic is most sensitive to, the population vulnerabilities can be considered from highest sensitivity (more vulnerable individuals) to lowest (fewer vulnerable individuals) sensitivity. It should be noted that risks which appear to have lower sensitivity levels should not be considered irrelevant for the community.

Prioritizing Risk and Vulnerable

Climate change impacts will affect everyone and Village policies and actions should consider climate adaptive needs of the entire community. As with all planning efforts climate adaptation benefits from analysis in order to assist in establishing priorities for initial efforts. An effort to structure a prioritization should not be seen as an attempt to discard the need to address climate impacts for any population within the Village - whether or not it is defined as one of the “vulnerable” populations . Prioritization, however, is necessary to ensure the greatest impact and effectiveness of limited Village resources.

Based on the above review the Village’s adaptive efforts may be most effective by prioritizing strategies which address the climate risks of Air Quality, Extreme Heat, Flooding, Power/Infrastructure Failure, Energy Costs, and Food Insecurity. Particular attention should be paid to strategies which are most effective for Seniors over 65, People of Color, and those in Economic Stress.

Health and Safety

Northbrook Climate Risk

The chart below reviews the expected climate impacts, likelihood of occurrence, impact level (Vulnerable Population Climate Impact Sensitivity), potential timeframe of impact, and resulting overall potential risk level for climate risks to the population. Each of these impacts are already experienced. The timeframes represent estimations of when the likelihood of occurrence and/or the overall level of impact may be significantly increased. The timeframes should be understood to be approximate and include "short-term" (current to 20 years), "medium-term" (mid-century) and "long-term" (late century).

Health Impacts	Expected Impact(s)	Likelihood of Occurrence	Impact Level (Population Vulnerability)	Timeframe	Risk (Likelihood x Impact)	Impact-related Indicators
Extreme Heat	Increased demand for cooling; heat stress and emergency visits, heat related health	Likely	High	Medium-term	High	Cooling Degree Days, days above 95
Flooding	damage to property; flood related health impacts; infrastructure impacts	Likely	High	Short-term	Very High	Flood events, flash flood occurances, wettest 5-day periods, number of heavy rain events, disaster declarations, change in NOAA storm
Drought	Damage to crop/tree/ecosystem, reduced drinking water source, increased flash flood potential due to decreased soil permeability	Possible	Moderate	Medium-term	Moderate	Consecutive days without rain, acquafer level, surface water condition, river flow
Air Quality Impacts	Increased particulate matter, increased ozone impacts, increased instances of asthma	Likely	High	Medium-term	High	Air quality index
Vector-Borne Diseases	Increased instances of lyme disease, encephalitis, heart worm, malaria, zika virus	Likely	Moderate	Long-term	Moderate	Disease records
Nutrition Insecurity	Food price volitility/change, fluctuation in availability	Possible	High	Medium-term	High	Food price index, Foodshelf demand, % of school children qualifying for free and reduced lunch
Water Quanity/Quality Impacts	Water shortage, surface water quality impacts due to heat and stormwater runoff	Possible	Low	Long-term	Low	Acquafer health; Water quality test results
Water Borne Disease	Bacteria exposusure at infected surface water locations, contamination of drinking water due to flood	Unlikely	Moderate	Medium-term	Low	flood events; algea blooms

Priority Climate Risks for Northbrook

The priority climate risks to the population of Northbrook include Flooding, Extreme Heat, Air Quality, and Nutrition Insecurity Impacts while the priority climate risks to infrastructure/institutions include Land Use Planning, Buildings, Roads, Energy, and Agriculture and Forestry impacts.

Strategies Supporting Sector Goals

1. **Strategy HS 1:** Establish and expand public health communication campaigns to include climate change impacts.
2. **Strategy HS 2:** Assist the village's heat, flooding, storm, and poor air quality vulnerable population in preparing for and mitigating climate change impacts.
3. **Strategy HS 3:** Include climate impacts and health risks in new and updates to existing plans and policies.
4. **Strategy HS 4:** Strengthen community response capacity and support networks.
5. **Strategy HS 5:** Address the air quality risks associated with climate change.

Community Survey Responses Supporting Actions in Sector

How much do you agree with the following statement: "It is important for Northbrook to take action to prepare for the projected impacts of climate change like more heat waves, heavier rain events, and more days of

1 Strategy HS 1:

Establish and expand public health communication campaigns to include climate change impacts.

	Actions	Implementation Phase
HS 1-1	Provide guidance through resource material to social service providers so they are aware of best practices in treating client needs during an extreme heat event.	1
HS 1-2	Emphasize steps individuals can take to improve emergency preparedness. Increase awareness of Village and other alert systems	1
HS 1-3	Provide education around vegetation management of trees and how proper management can reduce storm-related power outages	1
HS 1-4	Coordinate with the County Health Department to provide up-to-date information to residents about the health effects of heat and Cooling Center locations throughout the County.	1
HS 1-5	Create and make available an Emergency Response Toolkit offering tips and suggestions for residents to increase their emergency preparedness	1
HS 1-6	Develop and deploy early warning response and community alert plans and systems (e.g., RAVE, Nixle) to notify residents and businesses - especially those most vulnerable - of poor air quality days, extreme weather events, extreme temperature events, potential energy and communication infrastructure failure, or other events which may pose health risks. Communication plan to include pathways for when community power and communication systems are non-functional.	2
HS 1-7	Make emergency communications available in multiple languages and platforms. The Village's top non-English languages should be addressed in the multiple-language communication plan. Platforms used should focus specifically on reaching the Village's top vulnerable populations identified in the Village's Climate Vulnerability Assessment.	2
HS 1-8	Provide education and resources about climate risks to the public, especially those most vulnerable to potential impacts of high-heat and extreme weather, translated to the Village's top non-English languages, via communication platforms typically relied upon for information by those populations	2

2 Strategy HS 2:

Assist the village's heat, flooding, storm, and poor air quality vulnerable population in preparing for and mitigating climate change impacts.

	Actions	Implementation Phase
HS 2-1	Encourage businesses and residents to move toward improved power resilience by making their building sites solar resilient: http://solarresilient.org/	1
HS 2-2	Prepare for public buildings to be used in different ways, both in lower-impact ways, such as seniors using the library to cool down during hot June days, and as safe-havens during acute emergencies.	1
HS 2-3	Establish cooling centers and provide information to the community to ensure vulnerable residents are aware of these services, including direct messaging at community facilities and through health providers, translated to the Village's top non-English languages.	2
HS 2-4	Establish a Resilient Home inspection referral list to provide voluntary on-site home reviews to identify possible resilience improvements such as flood mitigation strategies, improved weatherization, vegetative shading, etc. Explore a partnership with other agencies including Cook County, ComEd, and local schools.	2

3 Strategy HS 3:

Include climate impacts and health risks in new and updates to existing plans and policies.

	Actions	Implementation Phase
HS 3-1	Update or develop a community resilience plan to prioritize and prepare for responses in the event of a disaster and extreme weather events. Identify the location of critical facilities including hospitals, medical service providers, senior homes, child-care facilities, shelters, major and alternate transportation routes, public transit facilities and locations where hazardous chemicals are used or stored	1
HS 3-2	Continue to involve key community partners, such as hospitals, in emergency preparedness planning and management. Include the impacts of climate change as emerging threats in future response planning	1
HS 3-3	Update the Village emergency plans with specific climate change-related emergency materials. These could include press release templates, information on cooling/ heating centers, specific plans for populations requiring mobility assistance, and steps to identify and help populations affected by extended power outages, flooding, etc.	1
HS 3-4	Develop a debris management plan to support response to severe storm events and flooding	1
HS 3-5	Develop energy management plans for key facilities and cooling centers.	2
HS 3-6	Work with local electric utilities to conduct a grid capacity, conditions, and resilience assessment. Assessment recommendations should also identify strategies for improved energy resilience including solar+storage back-up.	2
HS 3-7	In infrastructure project design, consider plantings and infrastructure specifications and materials that will be resilient to heat-related climate change impacts and be cost-effective over the lifetime of the asset	2

4 Strategy HS 4:
Strengthen community response capacity and support networks..

	Actions	Implementation Phase
HS 4-1	Promote equity in hazard mitigation, and emergency response and recovery activities, and consider populations most vulnerable to weather-related emergencies in all plans and exercises, including evacuation routes, transportation for vulnerable population groups, shelter in place locations, back-up power operations, extended access to fuel/power sources and drinking water, etc.	1
HS 4-2	Increase community participation in health and wellness, exercise and nutrition programs	1
HS 4-3	Strengthen emergency management capacity to prepare for and respond to the impacts of climate change. The Village should prioritize capacity improvements such as training and equipment to address risks exacerbated by climate change. Emergency management should be equipped to address the possibility of multiple emergencies at the same time, such as the combination of western wildfire smoke air pollution coupled with extreme heat, or extreme heat combined with extreme weather and electrical outages.	1
HS 4-4	Improve the resilience of emergency response and communications systems. The Village Manager's Office will work with the Health and Human Services Department (HHS) Emergency Response Coordinator (ERC) and the Village's Emergency Manager for employee and resident emergency communications. They will routinely test and utilize communications systems and build in notifications and alerts for extreme environmental situations	2
HS 4-5	Enhance community networks and connections for those who require special attention, such as the elderly, homebound, disabled, isolated, or those likely to be in need of financial assistance during or after extreme weather events (heat, cold and heavy precipitation)	2

5 Strategy HS 5:
Address the air quality risks associated with climate change.

	Actions	Implementation Phase
HS 5-1	Educate public and public health professionals about health risks posed by climate change, including longer allergy seasons, potential changes in air quality and impacts on mental health. Include information on ways individuals can mitigate the health risks.	1
HS 5-2	In alignment with the American Public Health Association Policy Number: 201711, Village will expand outreach to better educate the public about the hazards of air pollution, including indoor air quality, and the steps individuals can take and available resources to reduce their exposure. In planning and conducting outreach efforts, the Village will explore collaboration with regional and national industry trade associations, nonprofit groups, and environmental organizations.	1
HS 5-3	Inventory, identify, and maintain adequate community-safe spaces for poor air quality. Popular community gathering spaces must be made safe during air quality emergencies (ozone, western wildfire smoke, etc). Options for improving safety include retrofits, upgrades, or other measures to ensure that these spaces are accessible and adequate for sensitive populations.	2

What You Can Do

You can support the goals of the Health and Safety section of the Northbrook Climate Action Plan as an individual, household, or a business. Here are just a few things you can do:

- Put together an emergency preparedness kit for your household by visiting https://www.ready.gov/
- Get involved with the Northbrook Community Emergency Response Team (CERT). Join your neighbors and receive training to prepare for potential disasters.
- Prepare your home for the extremes. Understand the risk of extreme weather, extreme temperatures, flooding or wildfire to your home, and take action to safeguard your home.
- Keep yourself and your family current with physicals, vaccinations and prescribed medications and therapies.
- Plan and rehearse a fire evacuation plan with everyone who lives in your home or apartment.
- Have breathing-protection masks available for you and your family for when air quality alerts are declared.
- Take first-aid and CPR certification training.
- Notice a person who lives alone. Offer to check on them periodically, especially during extreme weather or a natural disaster.
- Notice a person who sometimes lacks transportation to their doctor, shopping or other services. Offer to drive them.
- Notice a person or family who lacks air conditioning in their home or apartment. Offer to have them visit or stay with you during extreme heat events.

Greenspace
In Northbrook

37%
Average tree canopy coverage

36%
Impervious surface coverage

26%
Maintained lawn coverage

4.6°F
Average heat island index

Section 08
Greenspace and Ecosystem Health

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Greenspace and Ecosystem Health

Why Greenspace and Ecosystem Health Are Important

Human activities coupled with natural variations in the carbon cycle, have resulted in a significant increase in the concentration of carbon dioxide (CO2) and other "greenhouse gases" in the atmosphere, thus causing measurable global warming. Controlling atmospheric CO2 requires deliberate action that combines reducing emissions and increasing storage, while planning for adaptation to the changes that result. Part of this Climate Action Plan addresses ways that greenspace protection and enhancement is one of Northbrook's most important avenues for lowering our environmental footprint.

Greenspace, plays a central role in supporting community health, improving air, soil, and water quality, reducing energy use in buildings, and supporting climate -change mitigation. An urban greenspace includes any permeable vegetated surface, public or private, set apart for recreational, aesthetic, or ecosystem services (EC) in an otherwise urban environment. It is space set aside for providing life-essential benefits people and other living things obtain from properly-functioning ecosystems. The key benefits and services greenspaces provide include:

- Carbon sequestration: Plants on land convert carbon dioxide into biomass (leaves, stems, etc.) through photosynthesis. If more plants grow in more places, they will remove more CO2 from the atmosphere.
- Stormwater infiltration and flood mitigation: Greenspace helps protect from flash flooding by absorbing water through roots and slowing down rainwater running off.
- Reduce the urban heat island effect: The more vegetated greenspace we have in Northbrook, the better the cooling effects. High levels of impervious surfaces (a surface that does not allow water to infiltrate such as pavement and buildings) results in an increased urban heat island effect, which raises the temperature of the near-surface air, buildings, and pavement higher than the surrounding areas.
- Purify and humidify the air: Plants purify the air when they absorb light, carbon dioxide, and water to manufacture sugar.
- Support pollinators: Animal species that pollinate plants, termed pollinators, carry pollen, either accidentally or intentionally, from the male part of a flower to the female part of the same or another flower.

Climate Change Considerations

Climate Hazards

Projected climate change impacts may cause forests and urban trees to experience increased mortality and reduced productivity, more prevalent invasive species and disease all resulting in forest and tree loss, reduction in crop yield. Loss of greenspace, in turn, reduces carbon capture potential of green infrastructure.

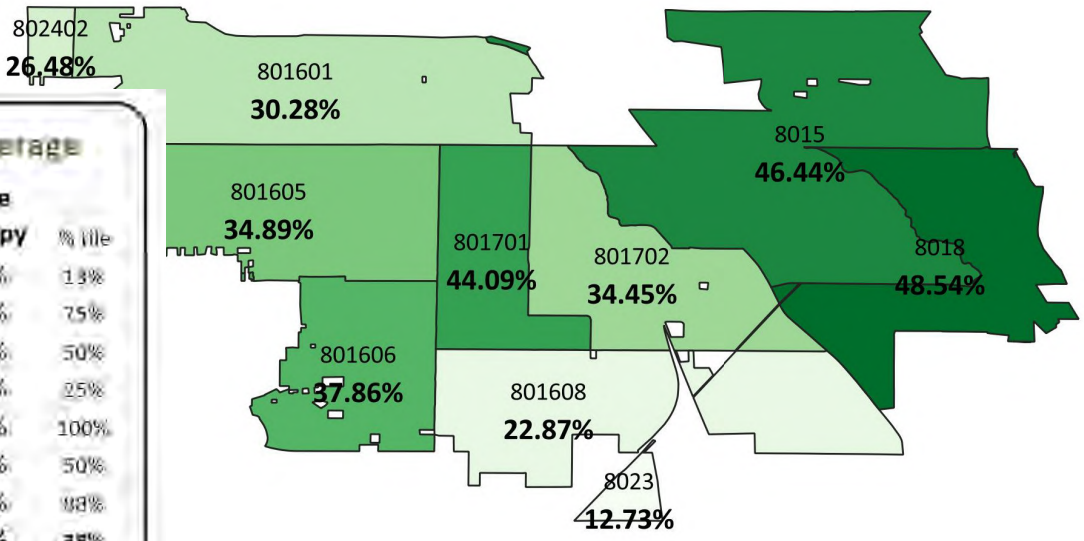
Opportunities

Many strategies within the Greenspace sector can advance community resilience and quality of life. Increased tree canopy, decreased impervious surfaces, and increased utilization of native grasses and plantings can reduce heat island experiences, energy consumption, stormwater runoff, and flood impacts.

Greenspace and Ecosystem Health

Northbrook's Tree Canopy

The City's average existing Tree Canopy coverage of 37.08% is above the national average, however, it is at the 38th percentile of peer communities in the Chicago area. There are also portions of the village with coverage as low as 13% which could benefit from increased tree canopy.



Tree Canopy Coverage

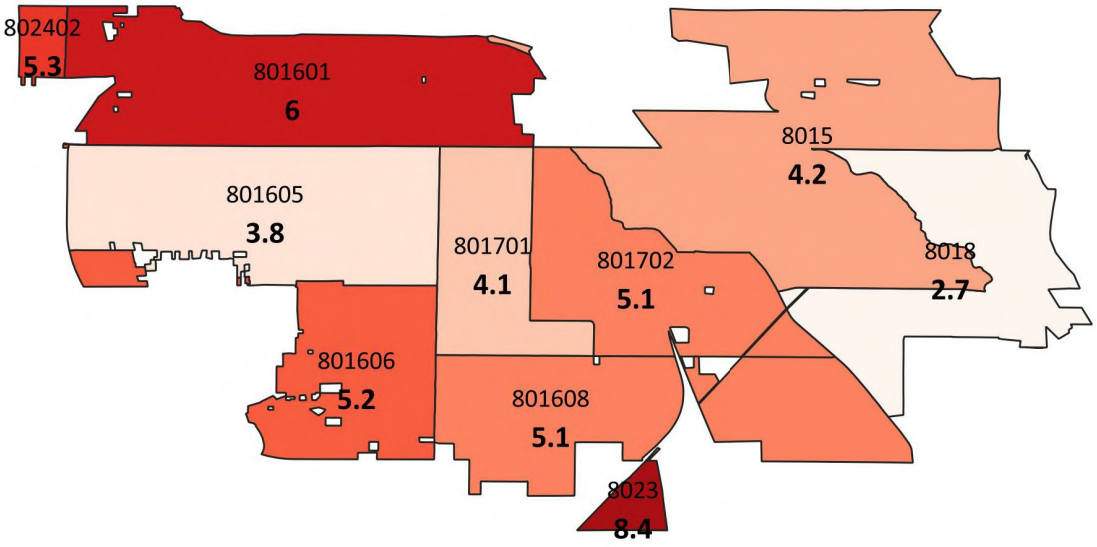
Community	Tree Canopy	% tile
Blue Island	21%	13%
Deerfield	40%	75%
Evanston	38%	50%
Glenview	34%	25%
Highland Park	49%	100%
Oak Park	38%	50%
Park Forest	42%	88%
Northbrook	**37%**	**38%**

Source: Chicago Region Trees Initiative

Northbrook's Heat Island Contribution

Heat island refers to the phenomenon of higher atmospheric and surface temperatures occurring in developed areas than those experienced in the surrounding rural areas due to human activities and infrastructure. Increased heat indicies during summer months due to heat island effects effectively raise human discomfort and health risk levels in developed areas, especially during heat waves.

Based on a 2006 study done by Minnesota State University and the University of Minnesota, the relationship between impervious surface percentage of a Village and the corresponding degree of heat island temperature increase can be understood as a ratio. Northbrook's average heat island contribution is calculated at 4.6°F.



Greenspace and Ecosystem Health

Tree Canopy Goal

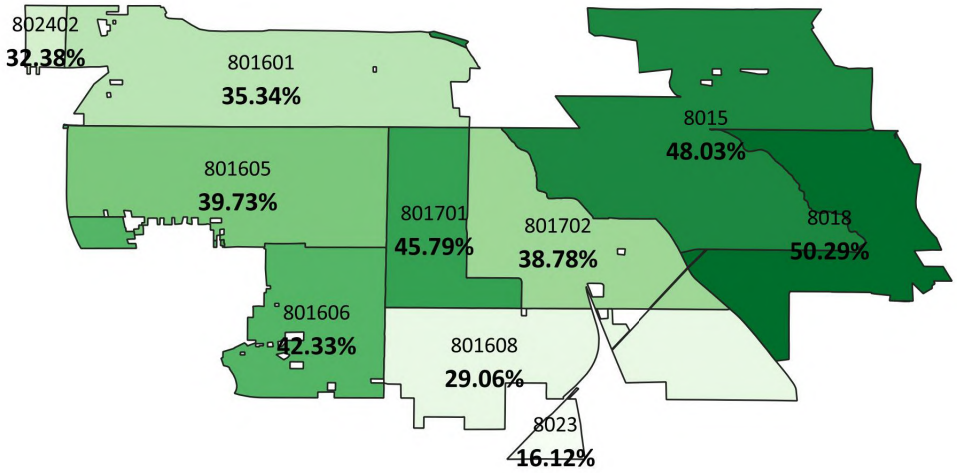
The recommended goals for 2040 Tree Canopy coverage are based on individual neighborhood calculations, corresponding to the neighborhood prioritizations outlined in the Findings Section of the Tree Survey and Carbon Sequestration Assessment. 2040 Tree Canopy goals are first calculated as Tree Stock goals, that is, goals calculated against the total potential Tree Stock area (existing tree canopy area + existing lawn/grass/shrub area), with a progressive percentage increase goal based on neighborhood prioritization. As the total Tree Stock area (potential tree canopy) varies by neighborhood, the resulting Tree Canopy percentage varies for each neighborhood.

The recommended Tree Stock increase goals are:

For neighborhoods in the top 1/3rd Neighborhood Priority Ranking:	10%
For neighborhoods in middle 1/3rd Neighborhood Priority Ranking:	7%
For neighborhoods in bottom 1/3rd Neighborhood Priority Ranking:	2.5%

City Wide Average 2040 Tree Canopy Coverage Goal (CT)

40.8%
Total

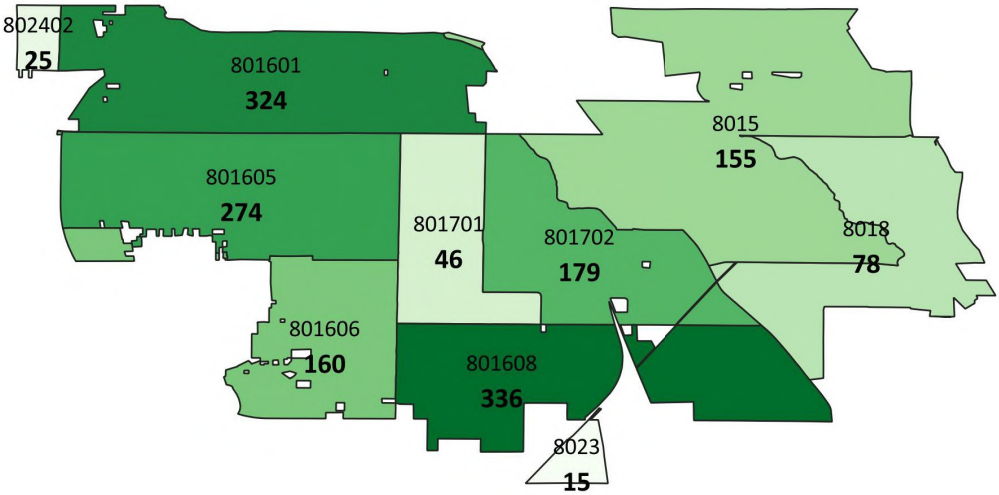


New Tree Planting Annual Target to Meet 2040 Goal

To meet the community wide tree canopy goal, the community will need to plant:

1,584
Trees Annually

15
Acres Annually



Greenspace and Ecosystem Health

Equity Considerations

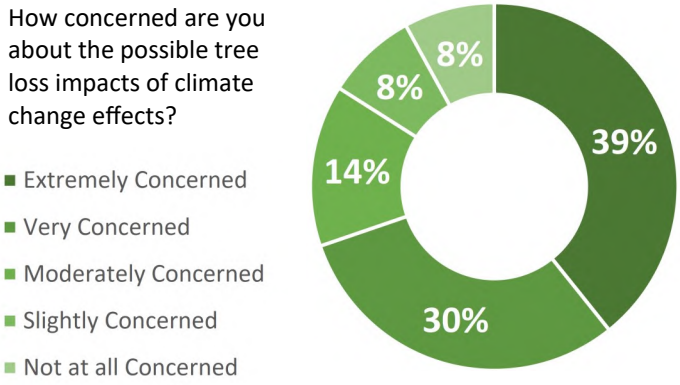
- Lower income neighborhoods and neighborhoods with higher proportions of people of color regularly have lower tree canopy coverage, and the environmental, economic, and quality of life benefits trees support than more affluent neighborhoods.
- "Heat islands" and "micro heat islands" are built up areas that are hotter than other nearby areas. This is caused by lack of adequate greenspace and healthy tree canopy coverage combined with too many hard surfaces like roads, parking lots, and hard building surfaces. Frequently neighborhoods with higher vulnerable populations have the highest heat island impacts.

Strategies Supporting Sector Goals

1. **Strategy GS 1:** Increase Tree Cover and Diversity.
2. **Strategy GS 2:** Increase the resilience and use of Native Species and Pollinator Restorations Areas with a targeted increase of 1.5% communitywide land pollinator restoration coverage.
3. **Strategy GS 3:** Reduce, repurpose, and reimagine lawn space.
4. **Strategy GS 4:** Reduce Heat Island Effect through Village Wide impervious surface reduction of 2% by 2030 and 5% by 2040.

Community Survey Responses Supporting Actions in Sector

How concerned are you about the possible tree loss impacts of climate change effects?



Greenspace and Ecosystem Health

1 Strategy GS 1:

Increase Tree Cover and Diversity (Communitywide Tree Canopy coverage goal from 37.08% to 39% by 2030 and 40.8% by 2040).

	Actions	Implementation Phase
GS 1-1	Develop an "All Things Green implementation Plan" to achieve tree canopy goals by neighborhood/census tract based on findings and recommendations of the Village of Northbrook Tree Survey and Carbon Sequestration study. include identification of priority planting areas. Implementation plan should include species diversity goals for the City, prioritizing drought and flood resistant varieties and varieties likely to be resistive to changing climate and USDA Hardiness zones for City (see appendix 2 of Village of Northbrook Climate Vulnerability Assessment as well as Chicago Botanic Garden's "Trees for 2050"). Species recommendation list to be distributed to and promote among residents, businesses, and contractors within the village.	1
GS 1-2	Conduct a Solar and Tree Compatibility study to actively identify the best sites in the city for tree canopy expansion as well as the best locations for solar PV installations. Following study, work to direct and encourage tree planting and solar PV development in areas identified	1
GS 1-3	Assist Village residents to plant trees on their property by offering trees at cost through a Village sponsored sale. Encourage community groups to make tree seedlings available at appropriate venues such as Earth Day or the Farmer's Market. goal of 500+ per year. (Example: Naperville's annual sale https://www.naperville.il.us/residents/our-urban-forest/arbor-day-tree-sale/	1
GS 1-4	Accelerate tree replacement programming in neighborhoods that will be most impacted by urban heat island effect and Emerald Ash Borer.	1
GS 1-5	Identify vulnerable urban tree canopy and street tree sections and develop policies to incentivize, encourage, or require strategic tree planting for heat island mitigation.	2
GS 1-6	Add or modify park and boulevard plantings in under-served areas, and increase maintenance to sustain mature tree canopy, decrease tree hazards and delay tree replacement needs.	2
GS 1-7	Preserve existing forested areas through practices that re-purpose already developed areas, such as establishing codes that retain minimum canopy cover on new developments and minimize removal of native soil, ground cover, and shrubs.	2
GS 1-8	Explore options for public and private partnerships to help reduce or share the cost of tree planting and maintenance.	2
GS 1-9	Work with local government and developers to ensure all socio-economic groups have access to trees and nature	2
GS 1-10	Conduct a community-wide ground cover study every 5 years or less to track and account for ground cover changes and tree gain and loss within Village limits	2
GS 1-11	Review and improve strategies for responding to pest and disease invasions	2
GS 1-12	Alter zoning codes to promote diversity of native tree cover, establish minimum tree coverage requirements, and performance based tree island within parking lots with goals on percentage of pavement shaded. Ordinance should encourage a mix of canopy trees, shrubs, groundcovers, and raingarden components appropriate to the lot and its surroundings. Revise Chapter 25 of the Northbrook Municipal Code to include a Tree Bank alternative compliance mechanism within code (example, City of Milton GA)	2

	Actions	Implementation Phase
GS 1-13	Create a pavement-to-parks de-pavement plan for neighborhoods to improve water absorption and decrease macro and micro-heat island impacts.	3
GS 1-14	Require new development to meet site plan review illustrating their capacity to meet village-wide tree canopy coverage goal (village wide average 40.8% by 2040) as well as on-site solar utilization in a manner that minimizes conflict between solar and trees.	3
GS 1-15	Adopt a No Net Loss policy for street trees and other publicly owned trees—every public tree that is removed shall be replaced by a tree of sufficient size (minimum 2" caliper). If a tree is removed in a location in which it is not feasible to replant, a new tree shall be planted in a nearby void space. Develop a municipal Tree Bank policy (example: Oregon City OR)	3

2 Strategy GS 2:

Increase the resilience and use of Native Species and Pollinator Restorations Areas with a targeted increase of 1.5% communitywide land pollinator restoration coverage.

	Actions	Implementation Phase
GS 2-1	Implement invasive species control programs including Integrated Pest Management, Protect the Best, Early Detection and Rapid Response and public and private invasive species identification and control.	1
GS 2-2	Increase the ability of green space to withstand drought conditions through replacement of turf with native prairie, wildflower, and native savanna plantings. (Green Zone certification: https://agza.net/green-zone-certifications/)	1
GS 2-3	Establish and effectively manage native-habitat corridors along sidewalks, trails and utility easement areas to restore and maintain landscape connectivity	1
GS 2-4	Restore Village-owned vacant properties to native plants and ecosystem types under the advice of native plant experts. (NWF Wildlife Habitat Certification: https://www.nwf.org/CertifiedWildlifeHabitat)	1
GS 2-5	Establish a lighting control ordinance to protect native plants, species, biodiversity, and improve night sky quality.	1
GS 2-6	Establish and promote a voluntary "Lights Out Northbrook" program durring months of high migratory bird activity. Program to encourage residents and businesses to voluntarily reduce or turn off lighting durring specific hours durring key migratory timeframes. Example: Lights Out Philly: https://cutt.ly/UvXfVdQ	1
GS 2-7	Establish a policy to eliminate neonicotinoids and reduce use of long-lasting chemical pesticides in Village landscaping practices. Encourage churches, schools, YMCA, Park District, and other public and private agencies to establish similar policies.	2
GS 2-8	Conduct a park and Village facility turf analysis and conversion study to identify lesser maintenance turf and ground cover types, to determine Native Plant and Pollinator Restoration Opportunities, and to establish a conversion master plan.	2
GS 2-9	Conduct a city-wide pollinator habitat assessment and pollinator corridor master plan.	2

3 Strategy GS 3:

Reduce, repurpose, and reimagine lawn space.

	Actions	Implementation Phase
GS 3-1	Commit to sustained participation in the Mayors Monarch Pledge to support pollinators, native plant landscaping, and discourage pesticides.	1
GS 3-2	Promote “Carbon Gardening” and "landscaping for absorption" practices among residents for lawns, ornamental gardens, and produce gardens. Strategies include native moisture tolerant perennial plantings and shrubs, elimination of synthetic fertilizer and pesticide use, high mow deck settings, use of biochar amendments, and polyculture lawn mixture	1
GS 3-3	Establish a policy committing to Integrated Pest Management practices and non-petrochemical fertilizer use on Village owned property. Promote reduced use community-wide through community education.	1
GS 3-4	Develop or promote existing guidelines and recommendations for types of vegetation for particular areas, such as parks, other open areas, and household backyards	1
GS 3-5	Cooperate with county, township, and urban governmental agencies, schools, clubs, libraries, neighborhoods, faith communities, and NGOs to provide and publicize workshops on gardening, landscaping, composting, and their importance in mitigating and adapting to the stresses of climate change on quality of life	1

4 Strategy GS 4:

Reduce Heat Island Effect through Village Wide impervious surface reduction of 2% by 2030 and 5% by 2040.

	Actions	Implementation Phase
GS 4-1	Develop educational and informational resources explaining the drivers and impacts of heat island and solutions which may offer multiple benefits for property owners and users to share with residents and businesses.	1
GS 4-2	Identify a Village owned building to implement as a green roof pilot project, or partner with another public agency within the Village such as the school district, park district, library, etc.	1
GS 4-3	Establish a Green Roof policy to promote and advance the development of green roofs on existing buildings and new construction. Encourage rooftop garden / farm installations which advance food security. Examples of incentive programs can be found at: https://cutt.ly/KkmZLDE	2
GS 4-4	Explore development of Green Roof, “Green Wall” / “Live Wall” and “vertical garden” incentives (demonstration projects, voluntary programs, incentivized program, ordinance / policy, tax credits or Stormwater Credits, no-interest loans,) to meet long-range dark impervious surface reduction goals.	2

	Actions	Implementation Phase
GS 4-5	Develop a policy that requires all commercial development projects receiving Village funding, PUD approval, and/or Conditional Use Permitting to implement commercial scale heat island mitigation strategies including cool surfaces, solar-friendly landscape shading strategies, impervious surface reduction, and breeze capture. Reference City's Net Zero Energy Building Guide for relevant strategies (see Buildings and Energy sector).	2
GS 4-6	The Village of Northbrook shall set standards for paving systems that reduce localized heating and promote groundwater retention [or minimize rainwater runoff], and shall update those standards every five years.	2
GS 4-7	Establish a cool roofs policy for Village owned buildings. Explore policy to establish cool roof requirement for new residential developments.	3
GS 4-8	Establish ordinances and/or incentives for developers to plant shade and water-absorbing trees and replace turf landscaping with native prairie, wild flower, and savanna plantings. Revise Sec. 25-34. "Ornamental and native grasses" of the Northbrook Municipal Code to include a "right to natural landscaping" clause to permit native natural grasses and landscapes. (Example: City of Minneapolis)	3

What You Can Do

You can support the goals of the Greenspace and Ecosystem Health section of the Northbrook Climate Action Plan as an individual, household, or a business. Here are just a few things you can do:

- Plant a rain garden with native plantings to absorb storm water and replenish our aquifers.
- Plant trees in your yard to provide shade and cooling in summer heat. Select trees suited for the changing climate of Northbrook. (https://www.chicagobotanic.org/plantinfo/tree_alternatives)
- Replace your lawn and landscape with drought-resistant, native or well-adapted, non-invasive plants.
- Make your backyard a Certified Wildlife Habitat with the National Wildlife Federation. www.nwf.org/garden-for-wildlife/certify
- Remove pavement and increase permeable surfaces. De-pave areas wherever possible to encourage stormwater infiltration onsite.
- Install bioswales/rain gardens or rainwater diversion systems to reduce impact on the stormwater system.
- Install a Green Roof (living roof) to reduce your energy consumption. Decrease heat island impacts, and reduce stormwater runoff.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Section 09
Climate Economy

Climate Economy

Why Climate Economy Is Important

Climate change and the economy are inexorably linked. Left unabated, the impacts of man-made climate change through the end of this century will cost the United States billions of dollars. According to a 2019 EPA study, the difference in economic impact between the global warming we face under "business-as-usual" increases and the global warming reduction goal established in the Paris Agreement may account for as much as $224 billion in economic impact annually by 2090. According to a 2019 World Bank report on trends in carbon pricing, a carbon price range of $40-$80 per ton is necessary by 2020 to reach the goals set by the 2015 Paris Agreement, while other studies have placed the full cost of carbon at $200-$400 per ton. The calculations outlined in Section 1 of this plan estimate a conservative localized cost for carbon at over $99 per ton.

The economy is also directly linked to climate action as well. One common reason given by those who wish not to see action taken on climate change is that the economy will be damaged. Setting aside the avoidance of the future costs should we not act to mitigate climate change, evidence is building a clear case that acting on climate change, and reducing fossil fuel emissions can be done without weakening the economy. Since 2010, Northbrook has seen villagewide GHG emissions drop over 21% while during that same period the village's GDP has ***increased*** over 13%.

"Climate Economy" refers to an economy that is both resilient to the projected impacts of climate change as well as supportive of reducing community-wide emissions in line with the goals of the Climate Action Plan. Many of the climate actions included in this plan can reduce Northbrook's contributions to global greenhouse gas levels, deal with the risks posed by climate change, and achieve economic growth and opportunity. Transformative change is needed now in how we build our cities, produce and use energy, transport people and goods, and manage our landscapes. This change also represents opportunities to improve our quality of life, improve health outcomes, and provide opportunities for workforce development, new job creation, and economic development. Additionally, many of the jobs potentials in Climate Action redirect funds away from less labor intensive (but more material resource intensive) sectors of the economy to support greater overall employment combined with less resource utilization. In general, economic opportunities include:

Energy Efficiency Jobs

Public Transit Jobs

Renewable Energy Jobs

Economic Savings

Climate Change Considerations

Climate Hazards

In many sectors, climate change will impact water and energy consumption and costs. Extreme weather and increasing variability in temperatures and precipitation may stress transportation systems and fleets. Increasing extreme weather hazards may threaten supply material and product supply chains.

Opportunities

Climate mitigation strategies like transformation of Northbrook's energy system, improvements to the energy efficiency of the village's building stock, enhancement of transportation alternatives, and the implementation of goals like tree canopy increases and reduction to impervious surfaces represent opportunities for the development of new businesses and job creation.

Climate Economy

Equity Considerations

- Low income individuals in our communities are especially prone to the impacts of climate change and bear a greatly disproportionate share of the costs—including vulnerability to job instability that can be brought about by extreme weather events and other climate change impacts.
- Income inequality is rising in the US, with September 2019 levels being the highest in 50 years—and the impacts of the COVID-19 pandemic have only increased these inequities. High inequality leads to lower life spans, increased instances of mental health issues, and increased obesity rates among other social impacts. Because the impacts and the costs of climate change are disproportionately felt by vulnerable populations and low-income individuals, climate change impacts will exacerbate income inequality in our communities.

Strategies Supporting Sector Goals

1. **Strategy CE 1:** Capture local economic potential of climate action.
2. **Strategy CE 2:** Increase workforce development for the climate economy.
3. **Strategy CE 3:** Build marketplace climate resilience.
4. **Strategy CE 4:** Financing The Village's climate action implementation.

1 Strategy CE 1:
Capture local economic potential of climate action.

	Actions	Implementation Phase
CE 1-1	Continue the Green Leadership Awards program to promote Northbrook as an environmentally friendly destination by highlighting the businesses that are taking steps to reduce resource consumption. Expand program to include environmental leadership among residents. https://www.northbrook.il.us/933/Green-Leadership-Awards	1
CE 1-2	Identify and promote locations for green businesses	1
CE 1-3	Encourage "green" businesses that are non-polluting, offer or support environmentally sustainable goods or services, and/or actively promote telecommuting, alternative work schedules, and alternative transportation modes.	1
CE 1-4	Foster small business and green business development, particularly those which increase renewable energy, climate mitigation and adaptation resources within the community.	2

Climate Economy

2 Strategy CE 2:
Increase workforce development for the climate economy.

	Actions	Implementation Phase
CE 2-1	Review the Affordable Housing Ordinance adopted by the Board of Trustees on 12 8, 2020 and identify current and future need for affordable housing including scenarios anticipating climate immigration and migration potentials. Plan should also integrate strategies, actions, and priorities which support the goals of this CAP plan such as prioritization of transit oriented affordable development sites, advancement of increased energy efficiency, renewable energy, and electrification strategies, and integration of climate adaptation, ground cover, and tree canopy considerations. Project example: https://cutt.ly/6vXjDVM	1
CE 2-2	Work with local partners to develop a community green jobs electronic bulletin board promoting local green job opportunities	2
CE 2-3	Promote alternatives to traditional building demolition such as relocation, deconstruction and salvage. Collaborate with partners to establish a jobs training program focused on building workforce with deconstruction skills and capacities. Job training program should focus on establishing job skills and placement for low income individuals. See Better Futures Program (https://betterfuturesminnesota.com/services/	2

3 Strategy CE 3:
Build marketplace climate resilience.

	Actions	Implementation Phase
CE 3-1	Work with the Northbrook Chamber of Commerce and community businesses to explore the creation of an incentivized “buy local” campaign to enhance resilience of small local businesses.	1
CE 3-2	Make sure key business infrastructure is recognized in the Village and County’s general hazard mitigation plan and emergency response plan	1
CE 3-3	Ensure redundancy in telecommunications and broadband networks to protect commerce and public safety in the event of natural or manmade disasters	2

4 Strategy CE 4:

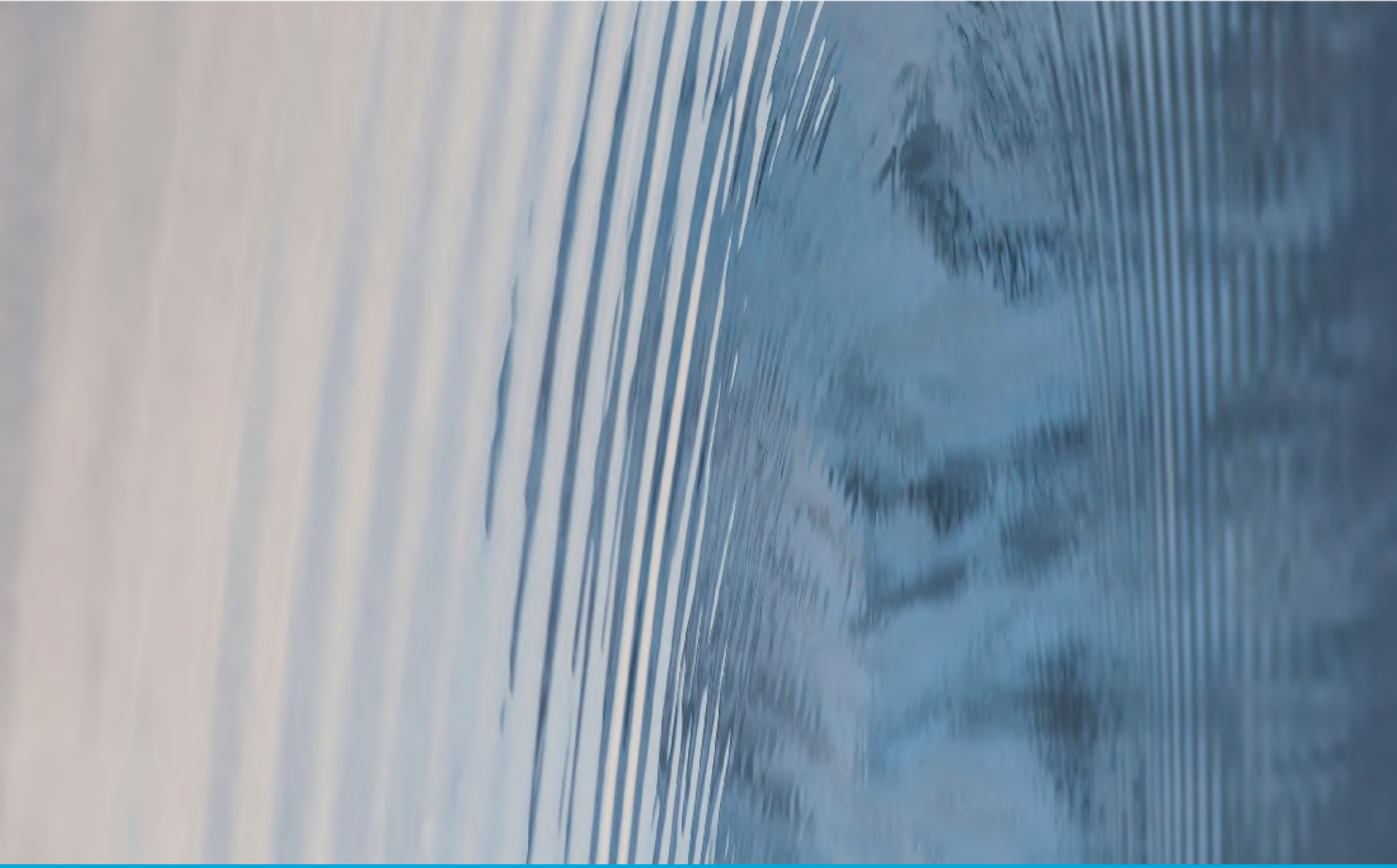
Strategy CE 4: Financing The Village's climate action implementation.

	Actions	Implementation Phase
CE 4- 1	Add a Carbon Impact Fee to all new development as a percentage of the building permit fee. Additional funds raised to be used for Climate Mitigation and Adaptation implementation. Projects may apply for a refund if they install on-site renewable energy system and provide documentation that demonstrates the system will offset either 40% or 80% of the project's average annual electricity demand. https://www.cityofwatsonville.org/DocumentCenter/View/198/Frequently-Asked-Questions-About-the-Carbon-Fund-Ordinance-PDF https://www.cityofwatsonville.org/	1
CE 4- 2	Establish a policy that designates Village Utility Franchise Fee Income as funding source for Climate Initiatives. Explore options for allocation of utility franchise fees for advancement of Village CAP goals prior to the next franchise fee agreement negotiation. (https://ilsr.org/energy/utility-franchise-fees/)	2

What You Can Do

You can support the goals of the Climate Economy section of the Northbrook Climate Action Plan as an individual, household, or a business. Here are just a few things you can do:

- Stay informed on local climate action news, events and progress by following the Village on Facebook, Twitter and Instagram
- Attend a Village-sponsored event or a Village Board of Trustees meeting to show your support for climate action.
- Shop and buy locally. We make Northbrook a more liveable, sustainable, equitable community when we spend our money here. Plus, it reduces the climate impacts of packaging and shipping.
- Buy a DNR Environmental License Plate for your vehicle. The proceeds will go toward protect Illinois' lands, waters and wildlife.
- Volunteer to help an organization — your employer, church, school, neighborhood association — with climate action. Not sure where to volunteer? Contact the Village and we'll help you find an opportunity.
- Write to your state representative and senator, telling them you support strong building codes and clean, renewable energy.



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Section 10
Climate Action Implementation

Climate Action Implementation

The first few years after plan adoption are critical to its success. Establishing roles, both internal and external, and identifying funding will help establish the implementation phase of the plan and ensure the community is on track to achieve its goals. This plan includes robust goals for significant GHG emission reductions and addressing climate resilience. This vision require commitment and integration of the CAP into Village operations, functions, and services.

Implementation is For Everyone

Implementation actions are detailed items that should be completed in order to carry out the vision and strategies identified in the plan. Some actions will need to be led by Village Board of Trustees, Village departments, and/or the business community; and there are some things that households and individuals can do to make an impact. While many actions will require Village Board of Trustees to amend a policy there will be opportunities for businesses, organizations, households, and individuals to support the Village Board of Trustees policy changes and provide input on and feedback on those policies. Ultimately, achieving the visionary energy efficiency, renewable energy, alternative transportation, and climate resilience goals outlined in this plan will require engagement and a sense of responsibility not only by the Village of Northbrook leadership and government, but by the community itself as well. It is critical for all to remain engaged and active, advancing and advocating for actions you feel are important.

General Implementation Recommendations

The following are foundational recommendations to support the long-range implementation of the CAP:

Building Internal Capacity

Continuing to build internal capacity will be important to help establish the CAP as a priority integral to internal operations as well as fostering connections to community partners, businesses, and individuals through outreach, education, special projects, and service delivery.

1. Establish clear guidance and direction for the participation in and support of the CAP implementation actions by all Village of Northbrook departments.
2. Fund and support Sustainability staffing required to:
    - Facilitate discussion among large users to reduce emissions through business and industrial strategies.
    - Participate in technical resource programs as they are available through County, State, Federal, and non-profit provider partners.
    - Support Village of Northbrook department managers and staff as they implement CAP actions within their service area or area of expertise.
    - Convene an internal Village climate working group that meets regularly and provides updates on progress and success, identifies additional support or resources needed to advance actions of the CAP, and collaboratively discusses strategies for more complex challenges.
    - Ensure the establishment and maintenance of a Village of Northbrook Climate Action webpage supporting CAP resources for the community.
    - Coordinate and organize volunteer groups and events.
    - Engage Village boards and commissions (e.g., Environmental Commission, Tree Commission, Commission on Sustainability, Park Department's Environmental Resources Advisory Council, Planning Commission, Village Board of Trustees Climate Action & Resilience Committee, etc.) to ensure the CAP is integrated into their work plans.
3. Review Climate Action Plan implementation progress and impacts on a regular basis (1-2 year cycle). Review should include development of an updated community wide GHG inventory. Strategies and actions should be reviewed for implementation progress and for continued appropriateness. Based on the review, adjust, add, and remove detailed CAP actions as appropriate.

Climate Action Implementation

External Support

Village staff and elected officials will not be able to implement this plan without robust support from community members and coordination with jurisdictional, institutional, and organizational partners.

1. Change the name of the EQC to "Sustainability Commission" with a change in mission and scope of work for the commission to support the mission of the Climate Action Plan, coordinate with Village staff in all relevant departments, and to receive updates on Village CAP projects and progress.
2. Establish a designated Village Board representative participant in the Village's internal climate working group in support of CAP implementation.
3. Establish a coordinated communication and education campaign supporting the educational and informational actions included in each of the CAP sections. The campaign should also look to help community members:
    - Understand why change at the individual, community, Village, and business level needs to occur,
    - How to make those changes correctly, and
    - What the benefit/incentive to them might be, for example, articulating that switching to solar energy and or an electric bus fleet might help reduce bills
4. Establish jurisdictional partnerships that advance CAP strategies to advance and accelerate action. This can include government entities like Cook County, the State of Illinois, conservation districts, utilities like ComEd and Nicor Gas; institutions like Oakton Community Collage or University of Illinois; Northbrook businesses, and community groups.

Funding

Funding the implementation of the CAP will require reallocation/reconsideration of existing Village funds, raising new Village funds, and identifying outside resources and funding opportunities. Some funds will need to be dedicated toward long-term support like staffing, while other funding will be on a project-by-project basis.

1. Maintain a budget and identify funding sources for staff dedicated to the implementation of the CAP.
2. Identify a budget necessary to support projects on an annual basis as per the detailed actions outlined in the Climate Economy section of the plan and climate actions.
3. Utilize no-cost technical assistance offerings as available.

Climate Action Implementation Support Tools

To support the Village in its initial implementation phase, the paleBLUEdot team has created a number of tools including:

- Implementation and Monitoring Matrix
- Example Climate Action Policies and Ordinances
  The paleBLUEdot team has assembled example policies and ordinances supporting some of the strategies and actions included in the Northbrook Climate Action Plan.
  The examples can be found on the following webpage:
  https://palebluedot.llc/northbrook-cap-policy-examples

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Section A1
GHG Forecast Assumptions

Village of Northbrook
GHG Forecast Assumptions:

Demographics:

- **Population:** Total Population projections through 2050 are projected based on Village's share of projected growth of the Local Area Allocation (LAA) developed in support of CMAP's ON TO 2050 forecast of population.
- **Households:** Total household counts through 2050 are projected based on Village's share of projected growth of the Local Area Allocation (LAA) developed in support of CMAP's ON TO 2050 forecast of households.
- **Jobs:** Total commercial and industrial jobs through 2050 are projected based on Village's share of projected growth of the Local Area Allocation (LAA) developed in support of CMAP's ON TO 2050 forecast of employment (note, share of commercial jobs and industrial jobs are projected using current percentages of total employment).

Climate Data

- **Cooling Degree Days (CDD):** Projected climate changes for the region will include increased summer temperatures. The increase in temperatures will result in an increase, or variability, in air conditioning demand. The forecast calculates annual changes in air conditioning demand based on projections provided by the "Climate Explorer" tool developed by US NOAA in support of the National Climate Assessment work. https://crt-climate-explorer.nemac.org/
- **Heating Degree Days (HDD):** Projected climate changes for the region will include increased winter temperatures. The increase in temperatures will result in a decrease, or variability, in building heating demand. The forecast calculates annual changes in heating demand based on projections provided by the "Climate Explorer" tool developed by US NOAA in support of the National Climate Assessment work. https://crt-climate-explorer.nemac.org/

Electricity:

- **Residential:** Demand is based on a per household basis and modified based on the projected Cooling Degree Days for each year, assuming 15% of electricity is used for cooling (RCP 8.5 model). 50% of projected increased electrical vehicle usage is attributed to residential EV charging.
- **Commercial and Industrial**: Demand is based on a per job basis and modified based on projected cooling degree days for each year, assuming that 15% of commercial and 7.5% of industrial electricity is used for cooling. (RCP 8.5 model). 50% of projected increased electrical vehicle usage is attributed to commercial EV charging
- **All electricity emission factors** are calculated using estimated emissions factors for 2030, 2040, and 2050 based on current, known, supplier commitments. For electrical suppliers with unknown or unestablished emission commitments, and for electricity purchased from the SERC grid, electricity emission factors are calculated based on EPA forecasts (https://fas.org/sgp/crs/misc/R45453.pdf). Estimated emissions factors are reduced 5% by 2030, 10% by 2040, and 15% by 2050.

Natural Gas:

- Residential: Demand is based on a per household basis and modified based on the projected Heating Degree Days for each year, assuming 75% of natural gas is used for heating (RCP 8.5 model).

- Commercial and Industrial: Demand is based on a per job basis and modified based on projected heating degree days for each year, assuming that 40% of commercial and 20% of industrial natural gas is used for heating (RCP 8.5 model).
- Natural Gas emissions factors are projected to be unchanged.

Transportation:

- Vehicle Miles Traveled is based on *Chicago* Metropolitan Agency for Planning (*CMAP*) projections. Trip data projections include trips with origin and destination within Village and trips with origin OR destination within Village. Trips with neither origin nor destination within Village (pass through only) are not included.
- https://www.fhwa.dot.gov/policyinformation/tables/vmt/vmt_forecast_sum.cfm
  Vehicle fuel use is calculated based on US Energy Information Agency projected rolling stock average fuel efficiency projections, modified to 85% projected MPG to account for heavy duty vehicle MPG share (based on US Department of Transportation data on current light duty to average all vehicle MPG ratios)
  https://www.eia.gov/todayinenergy/detail.php?id=31332
- Total vehicle stock is based on per household projections maintaining existing average number of vehicles per household through 2030 (2.556) and then reducing the average vehicle per household 10% through 2050 (2.3).
- Electric Vehicle Adoption: National projections expect an increased uptake of electric vehicles in coming years. The Edison Electric Institute has estimated that electric vehicle will be 7% of all vehicles on the road in the country by 2030. This projection is similar to the State of Illinois projections by the Citizens Utility Board in their report "Charging Ahead, Driving Value From Electric Vehicles For All Electricity Customers."
  (http://www.ehcar.net/library/rapport/rapport233.pdf, https://www.citizensutilityboard.org/wp-content/uploads/2019/03/Charging-Ahead-Deriving-Value-from-Electric-Vehicles-for-All-Electricity-Customers-v6-031419.pdf, https://berla.co/average-us-vehicle-lifespan/
  https://www.autosinnovate.org/resources/electric-vehicle-sales-dashboard).

Solid Waste:

- Total Solid Waste handled is based on total number of households and maintaining existing volume per household and emissions factors per ton handled.

Wastewater:

- Total Wastewater handled is based on total number of households and maintaining existing volume per household and emissions factors per household.

Note:

GHG emissions forecasts are not predictions of what will happen, but rather modeled projections of what may happen given certain assumptions and methodologies. GHG forecasts in this report should be interpreted with a clear understanding of the assumptions that inform them and the limitations inherent in any modeling effort.

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Section A2
Glossary of Terms

A

Activity Data
Data on the magnitude of a human activity resulting in emissions or removals taking place during a given period of time. Data on energy use, metal production, land areas, management systems, lime and fertilizer use and waste arisings are examples of activity data. (IPCC)

Adaptive Capacity
The social, technical skills, and financial capacities of individuals and groups to implement and maintain climate actions.

Aerosols
A collection of airborne solid or liquid particles, with a typical size between 0.01 and 10 micrometer that reside in the atmosphere for at least several hours. Aerosols may be of either natural or anthropogenic origin. Aerosols may influence climate in several ways: directly through scattering and absorbing radiation, and indirectly by acting as cloud condensation nuclei or modifying the optical properties and lifetime of clouds. (IPCC2)

Afforestation
Planting of new forests on lands that historically have not contained forests. (IPCC2)

Air Pollutant
Any man-made and/or natural substance occurring in the atmosphere that may result in adverse effects to humans, animals, vegetation, and/or materials. (CARB)

Anthropogenic
The term "anthropogenic", in the context of greenhouse gas inventories, refers to greenhouse gas emissions and removals that are a direct result of human activities or are the result of natural processes that have been affected by human activities. (USEPA2)

Atmosphere
The gaseous envelope surrounding the Earth. The dry atmosphere consists almost entirely of nitrogen (78.1% volume mixing ratio) and oxygen (20.9% volume mixing ratio), together with a number of trace gases, such as argon (0.93% volume mixing ratio), helium and radiatively active greenhouse gases such as carbon dioxide (0.035% volume mixing ratio) and ozone. In addition, the atmosphere contains the greenhouse gas water vapor, whose amounts are highly variable but typically around 1% volume mixing ratio. The atmosphere also contains clouds and aerosols. (IPCC2)

B

Baseline Emissions
A baseline is a measurement, calculation, or time used as a basis for comparison. Baseline emissions are the level of emissions that would occur without policy intervention or without implementation of a project. Baseline estimates are needed to determine the effectiveness of emission reduction programs (also called mitigation strategies).

Base Year
The starting year for the inventory. Targets for reducing GHG emissions are often defined in relation to the base year.

Biogenic
Produced by the biological processes of living organisms. Note that we use the term "biogenic" to refer only to recently produced (that is non-fossil) material of biological origin. IPCC guidelines recommend that peat be treated as a fossil carbon because it takes a long time to replace harvested peat.

Biogeochemical Cycle
Movements through the Earth system of key chemical constituents essential to life, such as carbon, nitrogen, oxygen, and phosphorus. (NASA)

Biomass
Either (1) the total mass of living organisms in a given area or of a given species usually expressed as dry weight; or (2) Organic matter consisting of or recently derived from living organisms (especially regarded as fuel) excluding peat. Includes products, by-products and waste derived from such material. (IPCC1)

Biomass Waste
Organic non-fossil material of biological origin that is a byproduct or a discarded product. "Biomass waste" includes municipal solid waste from biogenic sources, landfill gas, sludge waste, agricultural crop byproducts, straw, and other biomass solids, liquids, and gases; but excludes wood and wood-derived fuels (including black liquor), biofuels feedstock, biodiesel, and fuel ethanol. Note: EIA "biomass waste" data also include energy crops grown specifically for energy production, which would not normally constitute waste. (EIA)

Black Carbon
Operationally defined aerosol species based on measurement of light absorption and chemical reactivity and/or thermal stability; consists of soot, charcoal and/or possible light absorbing refractory organic matter (Charlson and Heintzenberg, 1995, p. 401). (IPCC2)

C
Carbon Cycle
All parts (reservoirs) and fluxes of carbon. The cycle is usually thought of as four main reservoirs of carbon interconnected by pathways of exchange. The reservoirs are the atmosphere, terrestrial biosphere (usually includes freshwater systems), oceans, and sediments (includes fossil fuels). The annual movements of carbon, the carbon exchanges between reservoirs, occur because of various chemical, physical, geological, and biological processes. The ocean contains the largest pool of carbon near the surface of the Earth, but most of that pool is not involved with rapid exchange with the atmosphere. (NASA)

Carbon Dioxide (CO_2)
A naturally occurring gas, and also a by-product of burning fossil fuels and biomass, as well as land-use changes and other industrial processes. It is the principal anthropogenic greenhouse gas that affects the Earth's radiative balance. It is the reference gas against which other greenhouse gases are measured and therefore has a Global Warming Potential of 1. (IPCC2)\

Carbon Dioxide Equivalent (CO_2e)
A metric used to compare emissions of various greenhouse gases. It is the mass of carbon dioxide that would produce the same estimated radiative forcing as a given mass of another greenhouse gas. Carbon dioxide equivalents are computed by multiplying the mass of the gas emitted by its global warming potential.

Carbon Disclosure Project (CDP)
An international organization that administers a platform for organizations and cities to publicly disclose their environmental impacts, such as climate risk. CDP is one of the approved disclosure platforms utilized by GCoM.

Carbon Emissions
The release of carbon dioxide into the atmosphere. Primary human sources of the release of carbon dioxide occur from burning oil, coal, and gas for energy use.

Carbon Equivalent (CE)
A metric measure used to compare the emissions of the different greenhouse gases based upon their global warming potential. Carbon equivalents can be calculated from to carbon dioxide equivalents by multiplying the carbon dioxide equivalents by 12/44 (the ratio of the molecular weight of carbon to that of carbon dioxide). The use of carbon equivalent is declining in GHG inventories.

Carbon Intensity
The amount of carbon by weight emitted per unit of energy consumed. A common measure of carbon intensity is weight of carbon per British thermal unit (Btu) of energy. When there is only one fossil fuel under consideration, the carbon intensity and the emissions coefficient are identical. When there are several fuels, carbon intensity is based on their combined emissions coefficients weighted by their energy consumption levels. (EIA)

Carbon Neutrality
For the purposes of the Plan, Carbon Neutrality refers to the point at which the organization / organization's net greenhouse gas emissions reach 0. This will likely be achieved through a combination of reducing emission sources and offsetting and sequestering any remaining emissions.

Carbon Sinks
A forest, ocean, or other natural environment viewed in terms of its ability to absorb carbon dioxide from the atmosphere.

Carbon Sequestration
This refers to the capture of CO_2 from the atmosphere and its long term storage in oceans (oceanic carbon sequestration), in biomass and soils (terrestrial carbon sequestration) or in underground reservoirs (geologic carbon sequestration).

Chlorofluorocarbons (CFCs)
Greenhouse gases covered under the 1987 Montreal Protocol and used for refrigeration, air conditioning, packaging, insulation, solvents, or aerosol propellants. Because they are not destroyed in the lower atmosphere, CFCs drift into the upper atmosphere where, given suitable conditions, they break down ozone. These gases are being replaced by other compounds, including hydrochlorofluorocarbons and hydrofluorocarbons, which are greenhouse gases covered under the Kyoto Protocol. (IPCC3)

Circular Economy
An alternative to a traditional linear economy (make, use, dispose) in which an economy is a regenerative system where resource input and waste are minimized. This is achieved through long-lasting product design, repair, reuse, remanufacturing, and recycling. Circular economy strategies are often cited as systems level approaches to reducing waste generation through product and system design.

Climate
Climate in a narrow sense is usually defined as the "average weather" or more rigorously as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. The classical period is 30 years, as defined by the World Meteorological Organization (WMO). These relevant quantities are most often surface variables such as temperature, precipitation, and wind. Climate in a wider sense is the state, including a statistical description, of the climate system. (IPCC2)

Climate Adaptation or Resilience
The capacity of a natural environment to prevent, withstand, respond to, and recover from a disruption. The process of adjusting to new climate conditions in order to reduce risks to valued assets.

Climate Change
Climate change refers to a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer). Climate change may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use. (IPCC2)

Climate Hazard
An extreme climate event or condition that can harm human health, livelihoods, or natural resources. It can include abrupt changes to the climate system such as extreme precipitation, storms, droughts, and heat waves.

Climate Risk
The potential for consequences where something of value is at stake and where the outcome is uncertain, recognizing the diversity of values. Risk is often represented as probability of occurrence of hazardous events or trends multiplied by the impacts if these events or trends occur. Risk results from the interaction of vulnerability and hazard. (IPCC):

Climate Vulnerability
Is the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude and rate of climate change and variation to which a system is exposed, its sensitivity, and its capacity to adapt. Vulnerability = potential impact (sensitivity x exposure) – adaptive capacity (IPCC):

Climate Vulnerability Assessment
A report used to identify and define the risks posed by climate change and inform adaptation measures needed to combat climate change. Reports can be about a wide range of fields including food security, poverty analysis, and extreme weather events.

Cogeneration
Cogeneration is an industrial structure, installation, plant, building, or self-generating facility that has sequential or simultaneous generation of multiple forms of useful energy (usually mechanical and thermal) in a single, integrated system. (CARB)

Combined Heat and Power (CHP)
Combined heat and power is the simultaneous production of both electricity and useful heat for application by the producer or to be sold to other users with the aim of better utilisation of the energy used. Public utilities may utilise part of the heat produced in power plants and sell it for public heating purposes. Industries as auto-producers may sell part of the excess electricity produced to other industries or to electric utilities. (IPCC)

Community Solar
Solar facilities shared by multiple community subscribers who receive credit on their electricity bills for their share of the power produced. Community solar allows members of a community to share the benefits of solar power on their property without installing it on their own property. Electricity generated by the community solar farm typically costs less than the price from utility companies.

Complete Streets
A “complete street” is a design approach that requires streets to be designed to support safe, convenient and comfortable travel and access for users of all ages and abilities regardless of their mode of transportation.

Consistency
Consistency means that an inventory should be internally consistent in all its elements over a period of years. An inventory is consistent if the same methodologies are used for the base and all subsequent years and if consistent data sets are used to estimate emissions or removals from sources or sinks. (IPCC)

Continuous Emission Monitor (CEM)
A type of air emission monitoring system installed to operate continuously inside of a smokestack or other emission source. (CARB)

Criteria Air Pollutant
An air pollutant for which acceptable levels of exposure can be determined and for which an ambient air quality standard has been set. Examples include: ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, and PM10 and PM2.5. The term "criteria air pollutants" derives from the requirement that the U.S. EPA must describe the characteristics and potential health and welfare effects of these pollutants. The U.S. EPA and CARB periodically review new scientific data and may propose revisions to the standards as a result. (CARB)

D
Deforestation
Those practices or processes that result in the change of forested lands to non-forest uses. This is often cited as one of the major causes of the enhanced greenhouse effect for two reasons: 1) the burning or decomposition of the wood releases carbon dioxide; and 2) trees that once removed carbon dioxide from the atmosphere in the process of photosynthesis are no longer present and contributing to carbon storage. (UNFCC)

Distillate Fuel Oil
A general classification for one of the petroleum fractions produced in conventional distillation operations. It includes diesel fuels and fuel oils. Products known as No. 1, No. 2, and No. 4 diesel fuel are used in on-highway diesel engines, such as those in trucks and automobiles, as well as off-highway engines, such as those in railroad locomotives and agricultural machinery. Products known as No. 1, No. 2, and No. 4 fuel oils are used primarily for space heating and electric power generation. (EIA)

E
Emissions
The release of a substance (usually a gas when referring to the subject of climate change) into the atmosphere. (USEPA1)

Emission Factor
A coefficient that quantifies the emissions or removals of a gas per unit activity. Emission factors are often based on a sample of measurement data, averaged to develop a representative rate of emission for a given activity level under a given set of operating conditions. (IPCC)

Emission Inventory
An estimate of the amount of pollutants emitted into the atmosphere from major mobile, stationary, area-wide, and natural source categories over a specific period of time such as a day or a year. (CARB)

Emission Rate
The weight of a pollutant emitted per unit of time (e.g., tons / year). (CARB)

Environmental Justice
The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation and enforcement of environmental laws, regulations and policies

Estimation
Estimation is the assessment of the value of an unmeasurable quantity using available data and knowledge within stated computational formulas or mathematical models.

F
Fluorocarbons
Carbon-fluorine compounds that often contain other elements such as hydrogen, chlorine, or bromine. Common fluorocarbons include chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs). (UNFCC)

Flux
Either (1) Raw materials, such as limestone, dolomite, lime, and silica sand, which are used to reduce the heat or other energy requirements of thermal processing of minerals (such as the smelting of metals). Fluxes also may serve a dual function as a slagging agent. (2) The rate of flow of any liquid or gas, across a given area; the amount of this crossing a given area in a given time. (e.g., "Flux of CO2 absorbed by forests"). (IPCC)

Fossil Fuel
Geologic deposits of hydrocarbons from ancient biological origin, such as coal, petroleum and natural gas.

Fuel Combustion
Fuel combustion is the intentional oxidation of materials within an apparatus that is designed to provide heat or mechanical work to a process, or for use away from the apparatus. (IPCC)

Fugitive Emissions
Emissions that are not emitted through an intentional release through stack or vent. This can include leaks from industrial plant and pipelines. (IPCC)

G
Geologic Carbon Sequestration
It is the process of injecting CO_2 from a source, such as coal-fired electric generating power plant, through a well into the deep subsurface. With proper site selection and management, geologic sequestration could play a major role in reducing emissions of CO_2. Research efforts to evaluate the technical aspects of CO_2 geologic sequestration are underway. (USEPA4)

Global Warming
Global warming is an average increase in the temperature of the atmosphere near the Earth's surface and in the troposphere, which can contribute to changes in global climate patterns. Global warming can occur from a variety of causes, both natural and human induced. In common usage, "global warming" often refers to the warming that can occur as a result of increased emissions of greenhouse gases from human activities. Also see Climate Change (USEPA1)

Global Warming Potential (GWP)
An index, based upon radiative properties of well-mixed greenhouse gases, measuring the radiative forcing of a unit mass of a given well-mixed greenhouse gas in the present-day atmosphere integrated over a chosen time horizon, relative to that of carbon dioxide. The GWP represents the combined effect of the differing times these gases remain in the atmosphere and their relative effectiveness in absorbing outgoing thermal infrared radiation. The Kyoto Protocol is based on GWPs from pulse emissions over a 100-year time frame. (IPCC2)

GCOM Global Covenant of Mayors:
GCoM is the largest global alliance for city climate leadership, built upon the commitment of over 10,000 cities and

local governments. The alliance's mission is to mobilize and support climate and energy action in communities across the world.

Green Streets
A "green street" is a stormwater management approach that incorporates vegetation, soil, and engineered systems to slow, filter, and cleanse stormwater runoff from impervious surfaces.

Greenhouse Effect
Trapping and build-up of heat in the atmosphere (troposphere) near the earth's surface. Some of the heat flowing back toward space from the earth's surface is absorbed by water vapor, carbon dioxide, ozone, and several other gases in the atmosphere and then reradiated back toward the earth's surface. If the atmospheric concentrations of these greenhouse gases rise, the average temperature of the lower atmosphere will gradually increase. (UNFCC)

Global Protocol for Community-Scale Greenhouse Gas Emissions Inventories:
A robust, transparent and globally-accepted framework that cities and local governments can use to consistently identify, calculate and report on city greenhouse gas emissions.

Greenhouse Gas
Any gas that absorbs infrared radiation in the atmosphere. Greenhouse gases include, but are not limited to, water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrochlorofluorocarbons (HCFCs), ozone (O_3), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). (UNFCC)

Green Infrastructure
An approach to managing precipitation by reducing and treating stormwater at its source while delivering environmental, social, and economic benefits. Stormwater runoff can carry trash, bacteria, and other pollutants and is a major cause of water pollution in urban areas.

Gross Domestic Product (GDP)
The sum of gross value added, at purchasers' prices, by all resident and non-resident producers in the economy, plus any taxes and minus any subsidies not included in the value of the products in a country or a geographic region for a given period, normally one year. It is calculated without deducting for depreciation of fabricated assets or depletion and degradation of natural resources. (IPCC3)

H

Halocarbons
A collective term for the group of partially halogenated organic species, including the chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs), halons, methyl chloride, methyl bromide, etc. Many of the halocarbons have large Global Warming Potentials. The chlorine and bromine-containing halocarbons are also involved in the depletion of the ozone layer. (IPCC2)

Hydrocarbons
Strictly defined as molecules containing only hydrogen and carbon. The term is often used more broadly to include any molecules in petroleum which also contains molecules with S, N, or O An unsaturated hydrocarbon is any hydrocarbon containing olefinic or aromatic structures. (IPCC)

Hydrofluorocarbons (HFCs)
Compounds containing only hydrogen, fluorine, and carbon atoms. They were introduced as alternatives to ozone depleting substances in serving many industrial, commercial, and personal needs. HFCs are emitted as by-products of industrial processes and are also used in manufacturing. They do not significantly deplete the stratospheric ozone layer, but they are powerful greenhouse gases with global warming potentials ranging from 140 (HFC-152a) to 11,700 (HFC-23). (USEPA1)

I

ICLEI Local Governments for Sustainability:
A membership organization for local governments to pursue reductions in carbon pollution and improvements in advancing sustainable urban development. ICLEI's members and team of experts work together through peer exchange, partnerships and capacity building to create systemic change for urban sustainability.

Intergovernmental Panel on Climate Change
The IPCC was established jointly by the United Nations Environment Programme and the World Meteorological Organization in 1988. The purpose of the IPCC is to assess information in the scientific and technical literature related to all significant components of the issue of climate change. The IPCC draws upon hundreds of the world's expert scientists as authors and thousands as expert reviewers. Leading experts on climate change and environmental, social, and economic sciences from some 60 nations have helped the IPCC to prepare periodic assessments of the scientific underpinnings for understanding global climate change and its consequences. With its capacity for reporting on climate change, its consequences, and the viability of adaptation and mitigation measures, the IPCC is also looked to as the official advisory body to the world's governments on the state of the science of the climate change issue. For example, the IPCC organized the development of internationally accepted methods for conducting national greenhouse gas emission inventories. (USEPA1)

K

Kilowatt Hour (kWh):
A measure of electrical energy equivalent to a power consumption of 1,000 watts for one hour.

Kyoto Protocol
The Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) was adopted in 1997 in Kyoto, Japan, at the Third Session of the Conference of the Parties (COP) to the UNFCCC. It contains legally binding commitments, in addition to those included in the UNFCCC. Countries included in Annex B of the Protocol (most Organisation for Economic Cooperation and Development countries and countries with economies in transition) agreed to reduce their anthropogenic greenhouse gas emissions (carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride) by at least 5% below 1990 levels in the commitment period 2008 to 2012. The Kyoto Protocol entered into force on 16 February 2005. (IPCC2)

L

Land Use and Land Use Change
Land use refers to the total of arrangements, activities and inputs undertaken in a certain land cover type (a set of human actions). The term land use is also used in the sense of the social and economic purposes for which land is managed (e.g., grazing, timber extraction and conservation). Land use change refers to a change in the use or management of land by humans, which may lead to a change in land cover. Land cover and land use change may have an impact on the surface albedo, evapotranspiration, sources and sinks of greenhouse gases, or other properties of the climate system and may thus have a radiative forcing and/or other impacts on climate, locally or globally. (IPCC2)

Living Streets
A "living street" combines the concepts of complete streets and green streets while putting additional focus on quality of life aspects for City residents.

LULUCF
Acronym for "Land Use, Land Use Change and Forestry", a category of activities in GHG inventories.

M

Megawatt Hour (MWH):
A measure of electrical energy equivalent to a power consumption of 1,000,000 watts for one hour.

Methane (CH_4)
A hydrocarbon that is a greenhouse gas with a global warming potential most recently estimated at 25 times that of carbon dioxide (CO_2). Methane is produced through anaerobic (without oxygen) decomposition of waste in landfills, flooded rice fields, animal digestion, decomposition of animal wastes, production and distribution of natural gas and petroleum, coal production, and incomplete fossil fuel combustion. The GWP is from the IPCC's Fourth Assessment Report (AR4).

Metric Ton
The tonne (t) or metric ton, sometimes referred to as a metric tonne, is an international unit of mass. A metric ton is equal to a Megagram (Mg), 1000 kilograms, 2204.6 pounds, or 1.1023 short tons.

Million Metric Tons (MMT)
Common measurement used in GHG inventories. It is equal to a Teragram (Tg).

Mitigation:
Actions taken to limit the magnitude or rate of long-term global warming and its related effects. Climate change mitigation generally involves reductions in human emissions of greenhouse gases.

Mobile Sources
Sources of air pollution such as automobiles, motorcycles, trucks, off-road vehicles, boats, and airplanes. (CARB)

Mode Share
The percentage of travelers using a particular type of transportation. Modal share is an important component in developing sustainable transport within a city or region because it reveals the level of utilization of various transportation methods. The percentage reflects how well infrastructure, policies, investments, and land-use patterns support different types of travel.

Model
A model is a quantitatively-based abstraction of a real-world situation which may simplify or neglect certain features to better focus on its more important elements. (IPCC)

Municipal Solid Waste (MSW)
Residential solid waste and some non-hazardous commercial, institutional, and industrial wastes. This material is generally sent to municipal landfills for disposal. (USEPA1)

N
Natural Sources
Non-manmade emission sources, including biological and geological sources, wildfires, and windblown dust. (CARB)

Net-zero Emissions (NZE)
Building A building or property that generates or offsets all energy consumed. If the City develops a NZE building code, this definition will have to be refined to provide additional guidance on calculating emissions and offsets to achieve net-zero emissions.

Nitrogen Fixation
Conversion of atmospheric nitrogen gas into forms useful to plants and other organisms by lightning, bacteria, and blue-green algae; it is part of the nitrogen cycle. (UNFCC)

Nitrogen Oxides (NO_x)
Gases consisting of one molecule of nitrogen and varying numbers of oxygen molecules. Nitrogen oxides are produced in the emissions of vehicle exhausts and from power stations. In the atmosphere, nitrogen oxides can contribute to formation of photochemical ozone (smog), can impair visibility, and have health consequences; they are thus considered pollutants. (NASA)

Nitrous Oxide (N_2O)
A powerful greenhouse gas with a global warming potential of 298 times that of carbon dioxide (CO_2). Major sources of nitrous oxide include soil cultivation practices, especially the use of commercial and organic fertilizers, manure management, fossil fuel combustion, nitric acid production, and biomass burning. The GWP is from the IPCC's Fourth Assessment Report (AR4).

O

Ozone (O_3)
Ozone, the triatomic form of oxygen (O_3), is a gaseous atmospheric constituent. In the troposphere, it is created both naturally and by photochemical reactions involving gases resulting from human activities (smog). Tropospheric ozone acts as a greenhouse gas. In the stratosphere, it is created by the interaction between solar ultraviolet radiation and molecular oxygen (O_2). Stratospheric ozone plays a dominant role in the stratospheric radiative balance. Its concentration is highest in the ozone layer. (IPCC2)

Ozone Depleting Substances (ODS)
A compound that contributes to stratospheric ozone depletion. Ozone-depleting substances (ODS) include CFCs, HCFCs, halons, methyl bromide, carbon tetrachloride, and methyl chloroform. ODS are generally very stable in the troposphere and only degrade under intense ultraviolet light in the stratosphere. When they break down, they release chlorine or bromine atoms, which then deplete ozone. (IPCC)

P

Perfluorocarbons (PFCs)
A group of human-made chemicals composed of carbon and fluorine only. These chemicals (predominantly CF_4 and C_2F_6) were introduced as alternatives, along with hydrofluorocarbons, to the ozone depleting substances. In addition, PFCs are emitted as by-products of industrial processes and are also used in manufacturing. PFCs do not harm the stratospheric ozone layer, but they are powerful greenhouse gases: CF_4 has a global warming potential (GWP) of 7,390 and C_2F_6 has a GWP of 12,200. The GWP is from the IPCC's Fourth Assessment Report (AR4).

Photosynthesis
The process by which plants take carbon dioxide from the air (or bicarbonate in water) to build carbohydrates, releasing oxygen in the process. There are several pathways of photosynthesis with different responses to atmospheric carbon dioxide concentrations. (IPCC2)

Point Sources
Specific points of origin where pollutants are emitted into the atmosphere such as factory smokestacks. (CARB)

Power Purchase Agreement (PPA)
A power purchase agreement (PPA), or electricity power agreement, is a contract between two parties; one party generates electricity (the seller) and the other party looks to purchase electricity (the buyer). Individual customers and organizations may enter into PPAs with individual developers or may join together to seek better prices as a group. PPAs can allow longer term commitments to renewable energy as well as a form of “direct” investing in new renewable energy generation.

Property-Assessed Clean Energy (PACE)

A program created for financing energy efficiency and renewable improvements on private property. Private property can include residential, commercial or industrial properties. Improvements can include energy efficiency, renewable energy and water conservation upgrades to a building.

Process Emissions
Emissions from industrial processes involving chemical transformations other than combustion. (IPCC)

R
Radiative Forcing
A change in the balance between incoming solar radiation and outgoing infrared (i.e., thermal) radiation. Without any radiative forcing, solar radiation coming to the Earth would continue to be approximately equal to the infrared radiation emitted from the Earth. The addition of greenhouse gases to the atmosphere traps an increased fraction of the infrared radiation, reradiating it back toward the surface of the Earth and thereby creates a warming influence. (UNFCC)

Reforestation
Planting of forests on lands that have previously contained forests but that have been converted to some other use. (IPCC2)

Regeneration
The act of renewing tree cover by establishing young trees, naturally or artificially - note regeneration usually maintains the same forest type and is done promptly after the previous stand or forest was removed. (CSU)

Renewable Energy
Energy resources that are naturally replenishing such as solar, wind, hydro and geothermal energy.

Renewable Energy Credits (RECs)
A market-based instrument that represents the property rights to the environmental, social and other non-power attributes of renewable electricity generation. RECs are issued when one megawatt-hour (MWh) of electricity is generated and delivered to the electricity grid from a renewable energy resource. The single largest category of reductions in Evanston's emissions has been through the purchase of RECs.

Residence Time
Average time spent in a reservoir by an individual atom or molecule. Also, this term is used to define the age of a molecule when it leaves the reservoir. With respect to greenhouse gases, residence time usually refers to how long a particular molecule remains in the atmosphere. (UNFCC)

Reservoir
Either (1) a component or components of the climate system where a greenhouse gas or a precursor of a greenhouse gas is stored; or (2) Water bodies regulated for human activities (energy production, irrigation, navigation, recreation etc.) where substantial changes in water area due to water level regulation may occur. (IPCC)

Respiration
The process whereby living organisms convert organic matter to carbon dioxide, releasing energy and consuming molecular oxygen. (IPCC2)

Retro-commissioning
The systematic process to improve an existing building's performance ensuring the building controls are running efficiently and balancing the designed use and the actual use of the building.

Ride-share
The practice of sharing transportation in the form of carpooling or vanpooling. It is typically an arrangement made through a ride-matching service that connects drivers with riders.

S

Scope 1:
Scope 1 includes emissions being released within the city limits resulting from combustion of fossil fuels and from waste decomposition in the landfill and wastewater treatment plant.

Scope 2:
Scope 2 includes emissions produced outside the city that are induced by consumption of electrical energy within the city limits.

Scope 3:
Scope 3 includes emissions of potential policy relevance to local government operations that can be measured and reported but do not qualify as Scope 1 or 2. This includes, but is not limited to, outsourced operations and employee commute.

Short Ton
Common measurement for a ton in the United States. A short ton is equal to 2,000 lbs or 0.907 metric tons. (USEPA1)

Sink
Any process, activity or mechanism that removes a greenhouse gas, an aerosol or a precursor of a greenhouse gas or aerosol from the atmosphere. (IPCC2)

Social Cost of Carbon
The social cost of carbon is a measure of the economic harm from climate change impacts, expressed as the dollar value of the total damages from emitting one ton of carbon dioxide into the atmosphere.

Solar Radiation
Electromagnetic radiation emitted by the Sun. It is also referred to as shortwave radiation. Solar radiation has a distinctive range of wavelengths (spectrum) determined by the temperature of the Sun, peaking in visible wavelengths. (IPCC2)

Source
Any process, activity or mechanism that releases a greenhouse gas, an aerosol or a precursor of a greenhouse gas or aerosol into the atmosphere. (IPCC2)

Stationary Sources
Non-mobile sources such as power plants, refineries, and manufacturing facilities which emit air pollutants. (CARB)

Sulfur Dioxide (SO_2)
A compound composed of one sulfur and two oxygen molecules. Sulfur dioxide emitted into the atmosphere through natural and anthropogenic processes is changed in a complex series of chemical reactions in the atmosphere to sulfate aerosols. These aerosols are believed to result in negative radiative forcing (i.e., tending to cool the Earth's surface) and do result in acid deposition (e.g., acid rain). (UNFCC)

Sulfur Hexafluoride (SF_6)
A colorless gas soluble in alcohol and ether, slightly soluble in water. A very powerful greenhouse gas with a global warming potential most recently estimated at 22,800 times that of carbon dioxide (CO_2). SF_6 is used primarily in

electrical transmission and distribution systems and as a dielectric in electronics. This GWP is from the IPCC's Fourth Assessment Report (AR4).

T

Terrestrial Carbon Sequestration

It is the process through which carbon dioxide (CO_2) from the atmosphere is absorbed by trees, plants and crops through photosynthesis, and stored as carbon in biomass (tree trunks, branches, foliage and roots) and soils. The term "sinks" is also used to refer to forests, croplands, and grazing lands, and their ability to sequester carbon. Agriculture and forestry activities can also release CO_2 to the atmosphere. Therefore, a carbon sink occurs when carbon sequestration is greater than carbon releases over some time period. (USEPA3)

Therm:

A unit of measure for energy that is equivalent to 100,000 British Thermal units, or roughly the energy in 100 cubic feet of natural gas. Often used for measuring natural gas usage for billing purposes.

Total Organic Gases (TOG)

Gaseous organic compounds, including reactive organic gases and the relatively unreactive organic gases such as methane. (CARB)

Transparency

Transparency means that the assumptions and methodologies used for an inventory should be clearly explained to facilitate replication and assessment of the inventory by users of the reported information. The transparency of inventories is fundamental to the success of the process for the communication and consideration of information. (IPCC)

Trend

The trend of a quantity measures its change over a time period, with a positive trend value indicating growth in the quantity, and a negative value indicating a decrease. It is defined as the ratio of the change in the quantity over the time period, divided by the initial value of the quantity, and is usually expressed either as a percentage or a fraction. (IPCC)

U

Urban Tree Canopy

Describes the makeup and characteristics of trees within the urban environment.

V

VMT Vehicle Miles Traveled:

A unit used to measure vehicle travel made by private vehicles, including passenger vehicles, truck, vans and motorcycles. Each mile traveled is counted as one vehicle mile regardless of the number of persons in the vehicle.

Vision Zero:

Vision Zero is a strategy to eliminate all traffic fatalities and severe injuries, while increasing safe, healthy, equitable mobility for all. https://visionzeronetwork.org/

W

Water Vapor

The most abundant greenhouse gas; it is the water present in the atmosphere in gaseous form. Water vapor is an important part of the natural greenhouse effect. While humans are not significantly increasing its concentration, it contributes to the enhanced greenhouse effect because the warming influence of greenhouse gases leads to a positive water vapor feedback. In addition to its role as a natural greenhouse gas, water vapor plays an important

role in regulating the temperature of the planet because clouds form when excess water vapor in the atmosphere condenses to form ice and water droplets and precipitation. (UNFCC)

Weather
Atmospheric condition at any given time or place. It is measured in terms of such things as wind, temperature, humidity, atmospheric pressure, cloudiness, and precipitation. In most places, weather can change from hour-to-hour, day-to-day, and season-to-season. Climate in a narrow sense is usually defined as the "average weather", or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. The classical period is 30 years, as defined by the World Meteorological Organization (WMO). These quantities are most often surface variables such as temperature, precipitation, and wind. Climate in a wider sense is the state, including a statistical description, of the climate system. A simple way of remembering the difference is that climate is what you expect (e.g. cold winters) and 'weather' is what you get (e.g. a blizzard). (USEPA1)

Z

Zero Emission Vehicles (ZEV)
A vehicle that does not emit harmful emissions during operation. Harmful emissions can have a negative impact on human health and the environment. Electric (battery-powered) cars, electric trains, hydrogen-fueled vehicles, bicycles, and carriages are considered to produce zero emissions.

Zero Waste
A cyclical system in which products are designed for reuse, which creates no waste. A zero waste system eliminates the volume and toxicity of waste and materials and conserves current resources through reuse.

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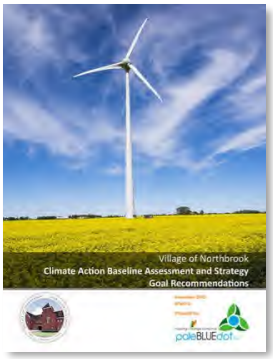
Section A3
Supporting Research

Supporting Research

Climate Action Baseline Study

To support the Village of Northbrook Climate Action Plan planning team members, the paleBLUEdot team assembled the Climate Action Baseline Study. This document provided a review of a wide range of community wide metrics, data, and comparisons against regional peer communities for each of the climate action plan sectors included in this report. The document also included preliminary sector specific draft strategic goal recommendations for the Climate Action Plan planning team to consider, discuss, and revise at the beginning of the planning team effort.



Click on the link below or scan the QR code to access the document:
https://view.publitas.com/palebluedot/northbrook-climate-action-baseline-assessment-and-strategy-goal-recommendations-wdwbog88kdqa/

Climate Vulnerability Assessment

At the beginning of the Climate Action Planning effort, the paleBLUEdot team developed a Climate Vulnerability Assessment for the Village of Northbrook. The assessment included the identification of vulnerable populations within the community and possible impacts and risks associated with projected climate change for the region. paleBLUEdot mapped the vulnerable populations within the Village as well as existing Village infrastructure and resources which may be capable of supporting climate adaptation strategies. These assessments provided a basis for understanding vulnerabilities and resources which supported the decision making process needed for identifying and prioritizing climate adaptation measures to be included in the final Climate Action Plan. The Assessment focused on Village-Wide vulnerabilities with a particular focus on climate vulnerable populations to ensure all populations benefit from proposed implementation measures.

Click on the link below or scan the QR code to access the document:
https://view.publitas.com/palebluedot/northbrook-climate-vulnerability-assessment/

Community Wide GHG Inventory

paleBLUEdot compiled a Community Greenhouse Gas Inventory. The assessment included collection of raw data and calculation of greenhouse gas emissions for each of the primary emissions sectors included in this Climate Action Plan. The inventory included both community-wide emissions as well as municipal operations. The report included community-wide emissions comparisons against communities within the State and region.

Click on the link below or scan the QR code to access the document:
https://view.publitas.com/palebluedot/northbrook-community-ghg-inventory/

Supporting Research

Community Wide Tree Survey and Carbon Sequestration Study

paleBLUEdot conducted a baseline assessment of Village-Wide ground cover and tree canopy extent. This baseline expanded on information vailable through the Village of Northbrook Forestry Department's Village owned and boulevard tree survey and covered Village-wide conditions. The study identified ground cover conditions (grass, water, wetland, tree canopy) Village-wide as well as by neighborhood/census tract. Based on the groundcover data, calculations were made for annual carbon sequestration rates, carbon stock, tree canopy/green space economic value, and pollution absorption rates (CO, O3, NO2, SO2, particulate pollution).

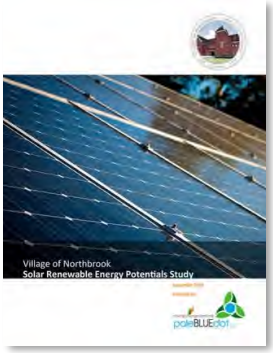
Included in this assessment was an assessment of Village-Wide heat island characteristics and conditions. The study identified impervious surface conditions and coverage (sidewalks, roadway, parking, and building) and compiled data in subcategories of light reflective and light absorbent conditions. Baseline calculations were made for overall heat island contribution coefficient by neighborhood (expressed as summer night time degrees F above natural conditions, calculations based on research and formulas compiled by the University of Minnesota and Minnesota State University).

Click on the link below or scan the QR code to access the document:
https://view.publitas.com/palebluedot/northbrook-tree-canopy-survey-report/

Community Wide Solar Energy Potentials Study

In support of development of effective renewable energy goalsetting and to establish strategies addressing renewable energy development, paleBLUEdot conducted a Community-Wide solar pv potentials study including economic and environmental benefits. This effort included:

1) Collect Village-wide satellite data (NREL, NOAA, and NASA data).
2) Determine building roof stock characteristics and solar suitable buildings, calculate total suitable areas by roof configuration/ orientation.
3) Calculate total rooftop solar capacity and annual energy generation by roof configuration/orientation.
4) Identify cost efficient annual energy generation potential.
5) Research solar market at national, State and regional levels. Identify low, medium, and high solar market absorption rates and Village-wide solar pv goals.
6) Identify environmental and economic benefit of solar including economic development and job creation potential. (NREL JEDI model)
7) Develop Village-Wide Renewable Solar Energy Potentials report.



Click on the link below or scan the QR code to access the document:
https://view.publitas.com/palebluedot/northbrook-renewable-potential/

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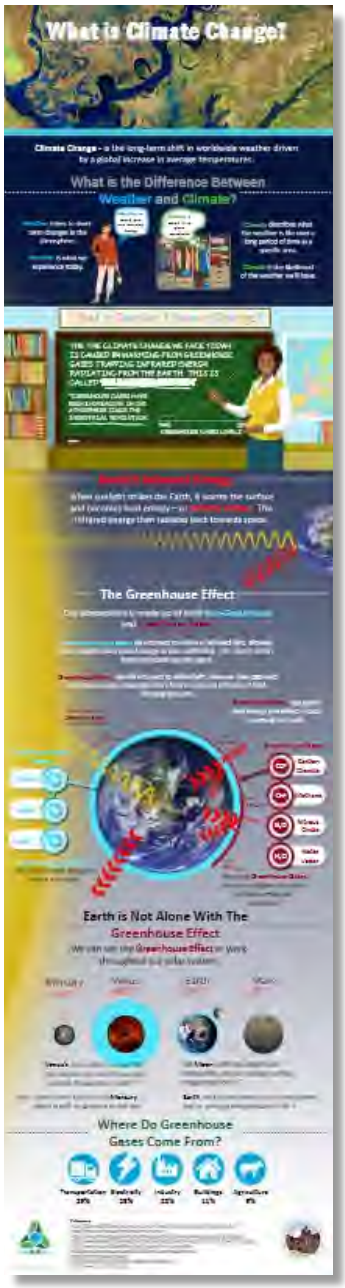
Section A4
Northbrook Climate Infographics

Northbrook Climate Infographics

Below are infographics developed during the Climate Action Plan planning effort in support of the Village's communications.

Click on the link below or scan the QR code to access the infographics:
https://palebluedot.llc/northbrook-climate-action-infographics



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Section A5
Cumulative Potential Cost Savings

Summary of Estimated Cumulative Savings of Modeled Reductions

Village of Northbrook

Notes

Transportation

VMT Reductions (public transit, bike, walk, etc)

Formula:

Cumulative vehicle miles saved x Average vehicle operation cost per mile = Gross VMT savings

	VMT saved (year 10)	10,963,210
	Cumulative vehicle miles saved:	60,297,657
1	Average vehicle operating cost per mile:	$0.688
	Gross VMT savings	**$41,484,788**

1 Savings per VMT based on AAA estimates https://exchange.aaa.com/automotive/driving-costs/#.YGUQZD9OlPY , https://www.slashgear.com/aaa-says-it-costs-about-74-cents-per-mile-to-drive-23496316/ https://www.thesimpledollar.com/save-money/is-it-really-cheaper-to-ride-the-bus/

Increased Public Transit Use (commuter)

Formula:

Cumulative increased public transit mileage x Average public transit cost per mile (commuter) = Increased spending on public transit

	Increased public transit miles (year 10)	4,231,414
	Cumulative increased public transit miles:	23,272,788
2	Average public transit cost per mile	$0.127
	Increased spending on public transit	**$2,961,991**

2 Cost per commuter public transit mile calculated using cost of monthly transit pass divided by average monthly commuter miles. https://www.census.gov/programs-surveys/sis/resources/data-tools/quickfacts.html https://www.transitchicago.com/passes/

EV and Alt Fuel Conversions

Formula:

Cumulative VMT converted to EV/alt fuel x Average vehicle operation cost savings per mile = Gross EV VMT savings

	VMT converted to EV/Alt fuel (year 10)	8,223,472
	Cumulative VMT converted to EV/alt fuel	45,229,095
3	Average cost savings per mile:	$0.103
	Gross EV VMT savings	**$4,651,059**

3 Savings per VMT converted from ICE to EV https://www.energy.gov/eere/electricvehicles/saving-fuel-and-vehicle-costsSavings per VMT converted from ICE to EV https://www.energy.gov/eere/electricvehicles/saving-fuel-and-vehicle-costs

Potential Total Cumulative Transportation Cost Savings

Formula:

Gross VMT savings - Increased spending on public transit + Gross EV VMT savings = Potentail Total Cumulative Transportation Cost Savigns

Gross VMT savings	$41,484,788
Increased spending on public transit	$2,961,991
Gross EV VMT savings	$4,651,059
Potentail Total Cumulative Transportation Cost Savigns	**$43,173,856**

Summary of Estimated Cumulative Savings of Modeled Reductions

Village of Northbrook

Notes

Energy - Ressidential

Residential Savings - grid electricity to solar

Formula:

Cumulative kWh converted to solar x Average cost savings per kWh = Residential solar savings

	Residential kWh converted (year 10)	17,929,383
	Cumulative residential kWh converted	98,611,609
3	Average solar cost savings per kWh	$0.052
	Residential solar savings	**$5,147,526**

Residential Savings - community solar

Formula:

Cumulative kWh converted to community solar x Average cost savings per kWh = Residential community solar savings

	Residential kWh converted (year 10)	13,447,038
	Cumulative residential kWh converted	73,958,707
3	Average solar cost savings per kWh	$0.001
	Residential solar savings	**$77,213**

3 The average cost savings per kWh of community solar subscription is estimated at 10%. The average cost savings per kWh consumed through on-site solar is calculated at 50% of the retail solar rate for residential and 30% for commercial. This assumes an average solar array payback period of 15 years (note, average residential payback period is estimated at 8 to 12 years and average commercial at 8 to 10 years see: https://www.solarreviews.com/blog/how-to-calculate-your-solar-payback-period and: https://www.paradisesolarenergy.com/blog/payback-and-roi-of-solar-energy-for-farms-businesses). The average solar array effective life span is typically anticipated as 30 years (see: https://www.solarpowerworldonline.com/2017/01/life-expectancy-solar-array/)The average cost savings per kWh of community solar subscription is estimated at 10%. The average cost savings per kWh consumed through on-site solar is calculated at 50% of the retail solar rate for residential and 30% for commercial. This assumes an average solar array payback period of 15 years (note, average residential payback period is estimated at 8 to 12 years and average commercial at 8 to 10 years see: https://www.solarreviews.com/blog/how-to-calculate-your-solar-payback-period and: https://www.paradisesolarenergy.com/blog/payback-and-roi-of-solar-energy-for-farms-businesses). The average solar array effective life span is typically anticipated as 30 years (see: https://www.solarpowerworldonline.com/2017/01/life-expectancy-solar-array/)

Residential Savings - electrical energy efficiency

Formula:

Cumulative kWh saved from energy efficiency x Average cost per kWh = Residential electrical energy efficiency savings

	Residential kWh saved (year 10)	19,909,660
	Cumulative residential kWh saved	109,503,130
4	Average cost per kWh	$0.104
	Residential electrical energy efficiency savings	**$11,432,127**

4 Energy efficiency savings per kWh saved based on average electricity cost per kWh: https://www.electricitylocal.com/

Residential Savings - natural gas energy efficiency

Formula:

Cumulative therms saved from energy efficiency x Average cost per therm = Residential natural gas energy efficiency savings

	Residential therms saved (year 10)	2,639,536
	Cumulative residential therms saved	14,517,446
5	Average cost per therm	$0.663
	Residential electrical energy efficiency savings	**$9,625,066**

5 Energy efficiency savings for natural gas is based on average natural gas cost per therm https://naturalgaslocal.com/

Residential Savings - increased electrical expenditures from fuel switching

Formula:

(Cumulative increased kWh from fuel switching + Cummulative increased kWh from electric vehicle charging) x Average cost per kWh = Residential increased electrical costs

	Residential increased kWh from fuel switching (year 10)	6,927,894
	Residential increased kWh from EV charging (year 10)	3,340,501
	Cumulative increased kWh	56,476,167
4	Average cost per kWh	$0.104
	Residential increased electrical costs	**$5,896,112**

Potential Total Cumulative Residential Energy Cost Savings

Formula:

Residential solar savings + Residential community solar savings + Residential electrical efficiency savings + Residential natural gas energy efficiency savings - Residential increased electrical costs = Potential Total Cumulative Residential Energy Savings

Residential solar savings	$5,147,526
Residential community solar savings	$77,213
Residential electrical efficiency savings	$11,432,127
Residential natural gas energy efficiency savings	$9,625,066
Residential increased electrical costs	$5,896,112
Potentail Total Cumulative Residential Energy Savings	**$20,385,820**

Summary of Estimated Cumulative Savings of Modeled Reductions

Village of Northbrook

Notes

Energy - Commercial

Commercial Savings - grid electricity to solar

Formula:

Cumulative kWh converted to solar x Average cost savings per kWh = Commercial solar savings

	Commercial kWh converted (year 10)	53,237,725
	Cumulative residential kWh converted	292,807,489
3	Average solar cost savings per kWh	$0.012
	Commercial solar savings	**$3,557,611**

Commercial Savings - community solar

Formula:

Cumulative kWh converted to community solar x Average cost savings per kWh = Commercial community solar savings

	Commercial kWh converted (year 10)	0
	Cumulative commercial kWh converted	0
3	Average solar cost savings per kWh	$0
	Commercial solar savings	**$0**

3 The average cost savings per kWh of community solar subscription is estimated at 10%. The average cost savings per kWh consumed through on-site solar is calculated at 50% of the retail solar rate for residential and 30% for commercial. This assumes an average solar array payback period of 15 years (note, average residential payback period is estimated at 8 to 12 years and average commercial at 8 to 10 years see: https://www.solarreviews.com/blog/how-to-calculate-your-solar-payback-period and: https://www.paradisesolarenergy.com/blog/payback-and-roi-of-solar-energy-for-farms-businesses). The average solar array effective life span is typically anticipated as 30 years (see: https://www.solarpowerworldonline.com/2017/01/life-expectancy-solar-array/)The average cost savings per kWh of community solar subscription is estimated at 10%. The average cost savings per kWh consumed through on-site solar is calculated at 50% of the retail solar rate for residential and 30% for commercial. This assumes an average solar array payback period of 15 years (note, average residential payback period is estimated at 8 to 12 years and average commercial at 8 to 10 years see: https://www.solarreviews.com/blog/how-to-calculate-your-solar-payback-period and: https://www.paradisesolarenergy.com/blog/payback-and-roi-of-solar-energy-for-farms-businesses). The average solar array effective life span is typically anticipated as 30 years (see: https://www.solarpowerworldonline.com/2017/01/life-expectancy-solar-array/)

Commercial Savings - electrical energy efficiency

Formula:

Cumulative kWh saved from energy efficiency x Average cost per kWh = Commercial electrical energy efficiency savings

	Commercial kWh saved (year 10)	72,959,376
	Cumulative commercial kWh saved	401,276,569
4	Average cost per kWh	$0.041
	Commercial electrical energy efficiency savings	**$16,251,701**

4 Energy efficiency savings per kWh saved based on average electricity cost per kWh: https://www.electricitylocal.com/

Commercial Savings - natural gas energy efficiency

Formula:

Cumulative therms saved from energy efficiency x Average cost per therm = Commercial natural gas energy efficiency savings

	Commercial therms saved (year 10)	2,085,047
	Cumulative commercial therms saved	11,467,757
5	Average cost per therm	$0.663
	Commercial electrical energy efficiency savings	**$7,603,123**

5 Energy efficiency savings for natural gas is based on average natural gas cost per therm https://naturalgaslocal.com/

Commercial Savings - increased electrical expenditures from fuel switching

Formula:

(Cumulative increased kWh from fuel switching + Cummulative increased kWh from electric vehicle charging) x Average cost per kWh = Commercial increased electrical costs

	Commercial increased kWh from fuel switching (year 10)	5,098,709
	Commercial increased kWh from EV charging (year 10)	6,014,340
	Cumulative increased kWh	61,121,767
4	Average cost per kWh	$0.041
	Commercial increased electrical costs	**$2,475,432**

Potential Total Cumulative Commercial Energy Cost Savings

Formula:

Commercial solar savings + Commercial community solar savings + Commercial electrical efficiency savings + Commercial natural gas energy efficiency savings - Commercial increased electrical costs = Potentail Total Cumulative Commercial Energy Savings

Commercial solar savings	$3,557,611
Commercial community solar savings	$0
Commercial electrical efficiency savings	$16,251,701
Commercial natural gas energy efficiency savings	$7,603,123
Commercial increased electrical costs	$2,475,432
Potentail Total Cumulative Commercial Energy Savings	**$24,937,003**

Summary of Estimated Cumulative Savings of Modeled Reductions

Village of Northbrook

Notes

Solid Waste - Residential

Residential savings - Food Waste Reduction

Formula:

Cumulative tons of food waste reduced and diverted x Average cost savings per ton = Residential food waste savings

	Residential food waste reduced (year 10)	2,640
	Cumulative residential food waste reduced	14,522
6	Average cost savings per ton reduced	$2,469
	Residential food waste savings	**$35,853,925**

6 Value per ton of residential food waste avoided is based on average for Prevent and Recover strategies by ReFED "A ROADMAP TO REDUCE U.S. FOOD WASTE" https://refed.com/downloads/the-roadmap-to-reduce-u-s--food-waste/ .

Potential Total Cumulative Residential Solid Waste Reduction Cost Savings

Residential food waste savings	**$35,853,925**

Notes

Solid Waste - Commercial

Commercial savings - Solid Waste Reduction

Formula:

Cumulative participant/years x Average reported cost savings per participant/year = Commercial solid waste savings

	Participating businesses (year 10)	120
	Cumulative participant/years	660
7	Average cost savings per participant/year	$475
	Commercial solid waste savings	**$313,500**

7 Savings per business engaged in waste reduction programs are based on MN WasteWise reported average business savings ($431) escallated to 5 year (mid point) Cumulative savings assume businesses remain. See https://www.mnchamber.com/your-opportunity/waste-wise operating within savings regime. Savings per business engaged in waste reduction programs are based on MN WasteWise reported average business savings ($431) escallated to 5 year (mid point) Cumulative savings assume businesses continue savings strategies. See https://www.mnchamber.com/your-opportunity/waste-wise operating within savings regime

Commercial savings - Food Waste Reduction

Formula:

Cumulative tons of food waste reduced and diverted x Average cost savings per ton = Commercial food waste savings

	Commercial food waste reduced (year 10)	3,227
	Cumulative residential food waste reduced	17,749
8	Average cost savings per ton reduced	$494
	Commercial food waste savings	**$8,764,293**

8 Values for commercial food waste are estimated at 20% of residential (retail) rates by ReFED "A ROADMAP TO REDUCE U.S. FOOD WASTE" https://refed.com/downloads/the-roadmap-to-reduce-u-s--food-waste/ .

Potential Total Cumulative Solid Waste Savings

Formula:

Residential Food Waste Savings + Commercial Solid Waste Savings + Commercial Food Waste Savings = Potentail Total Cumulative Solid Waste Savings

Residential Food Waste Savings	$35,853,925
Commercial Solid Waste Savings	$313,500
Commercial Food Waste Savings	$8,764,293
Potentail Total Cumulative Solid Waste Savings	**$44,931,718**

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