Forest Preserves of Cook County

Clean Energy Framework

May 2021

FOREST PRESERVES of Cook County

ILLINOIS Prairie Research Institute

fpdcc.com

Table of Contents

ILLINOIS
Prairie Research Institute

Prepared by the Illinois Sustainable Technology Center Technical Assistance Program.

About the Illinois Sustainable Technology Center Technical Assistance Program

The Illinois Sustainable Technology Center's (ISTC) Mission is to encourage and assist citizens, businesses and government agencies to prevent pollution, conserve natural resources, and reduce waste to protect human health and the environment in Illinois and beyond. ISTC's applied research lab and technical assistance team work together to advance best practices in pollution prevention, water conservation, energy efficiency, renewable energy and waste reduction.

ISTC's Technical Assistance Program (TAP) works with organizations in Illinois to reduce consumption of energy and natural resources and to minimize waste. TAP performs research, spreads awareness, and facilitates implementation regarding practices, technology and systems that improve sustainability.

TAP also assists clients by developing climate resilience adaptation strategies through identification of how climate change impacts their operations, products, or services, exploring proven, resilient responses and technologies to those impacts, and crafting strategies for relevant communication and engagement of stakeholders.

Questions about this report and project may be directed to:

April Janssen Mahajan
Email: alj5@illinois.edu
Office: 217.244.0469

100%

Introduction

Background

Illinois has experienced a 1°F increase in average annual temperature since the beginning of the 20th century. According to recent climate projections published by the National Oceanic and Atmospheric Administration (NOAA) and other authoritative scientific organizations, if global emissions of greenhouse gases continue to rise, historically unprecedented warming is anticipated in the Midwest region in the next few decades. Along with a projected rise in annual temperature, studies also project that the region likely will experience increased events of extreme precipitation during winter and spring, and intense summer droughts. When faced with such dire predictions, the inherent drive of the Forest Preserves to preserve and protect natural spaces for current and future generations led to its development of a Sustainability & Climate Resiliency Plan. The plan was produced in collaboration with the Technical Assistance Program of the Illinois Sustainable Technology Center (ISTC), a division of the Prairie Research Institute at the University of Illinois at Urbana-Champaign.

Published in September 2018, the **Sustainability & Climate Resiliency Plan** hinged upon an overall goal to reduce Forest Preserve greenhouse gas (GHG) emissions by 80% by 2050 from a 2016 baseline. It also identified a road map for Forest Preserve lands to be resilient in a changing climate, recognizing that such conditions will significantly impact land management operations as the range and distribution of species shift, along with availability of water and other key aspects of the local ecosystem.

The forests and natural habitats within Forest Preserve lands absorb atmospheric carbon dioxide and store it in the form of biomass. A 2004 study conducted by the Chicago Metropolitan Agency for Planning (CMAP) that calculated the value of green infrastructure of the region found that, “with nearly 70,000 acres of land, the Forest Preserves’ ecosystems absorb 1,544,887 tons of CO2 annually.” This fact, along with Preserves’ commitments to both increase GHG absorption capacity through land acquisition and restoration efforts while also reducing GHG emissions from operations, seemingly made the Forest Preserves well prepared to mitigate and adapt to regional impacts of climate change.

The recent findings presented in a report from a United Nations International Panel on Climate Change (UN-IPCC) made it clear that even these ambitious commitments might not be adequate. On January 22, 2019, in response to the UN-IPCC report, which demonstrated that the consequences of climate change will become irreversible in 12 years if global carbon emissions are not immediately and dramatically reduced, the **Forest Preserves of Cook County Board of Commissioners unanimously adopted a Net Zero Resolution.** This resolution revises the 80% greenhouse gas (GHG) emissions reduction goal to net-zero by 2050, as well as reducing facility GHG emissions by 45% and being 100% reliant on renewable energy for its building portfolio by 2030.

Established more than 100 years ago, and with responsibility for nearly 70,000 acres of natural areas and public open space, the Forest Preserves of Cook County is one of the largest and oldest forest preserve

districts within the United States. Its mission has been *"To acquire, restore and manage lands for the purpose of protecting and preserving public open space with its natural wonders, significant prairies, forests, wetlands, rivers, streams, and other landscapes with all of its associated wildlife, in a natural state for the education, pleasure and recreation of the public now and in the future."* This notion of preservation and stewardship for the benefit of both current and future generations is clearly in line with the concepts of sustainability and resiliency.

As part of its efforts to assist the Forest Preserves with implementation of the Sustainability & Climate Resiliency Plan, ISTC is currently working with the Forest Preserves to identify the most advantageous renewable energy strategies, develop a means to track emissions reduction efforts and progress, and update the Sustainability & Climate Resiliency Plan to reflect the revised goal of net-zero GHG emissions by 2050.

County Context

In response to the aforementioned UN-IPCC report, Toni Preckwinkle, President of the Cook County Board of Commissioners and President of the Forest Preserve District of Cook County Board of Commissioners, set forth the following goals for county-owned buildings:

- Carbon reduction of 45% by 2030 from a 2010 baseline.
- Carbon neutrality by 2050.
- 100% renewable electricity by 2030.

In July 2020, the County released its **Clean Energy Plan** to meet these goals. The Clean Energy Plan "prioritizes actions that are urgent, additional (new renewable energy that would not exist but for the County's efforts), local, resilient and reliable and cost-conscious." The Forest Preserves have adopted these same clean energy goals, along with the additional goal of ensuring that lands and related ecosystems are resilient in a changing climate.

The Cook County Clean Energy Plan consists of four different categories of activities, or tracks, for achieving the 100% renewable electricity and carbon neutrality goals:

- **REDUCE**, which focuses on reducing carbon emissions in existing buildings through energy efficiency efforts,
- **MAINTAIN**, which focuses on improvements in building monitoring, as well as employee education on the importance of energy reduction and best practices in operations,
- **RENEW**, which focuses on achieving the 100%renewable electricity by 2030 goal, and
- **SUPPORT**, which focuses on policies and procedures to provide the necessary internal support to execute the other three tracks.

It is important to note that Cook County defines "100% Renewable Electricity" as: "Using low- or no-carbon resources including but not limited to wind, solar, and geothermal for all electricity used in building operations. Cook County is not counting nuclear, waste-to-energy, or hydropower towards renewable energy, because of their other associated environmental impacts." The Forest Preserves will align its definition of what is considered renewable energy with that of the County for consistency with its own organizational values and regional efforts. For clarity, it should also be noted that the County defines "carbon neutrality" as the state in which the "amount of human-produced carbon dioxide equivalent emissions is balanced by clean energy sources." Carbon Dioxide Equivalent emissions, or CO2E, are "the standard unit of measurement and way greenhouse gas emissions are tracked and accounted for."

Purpose of This Document

This document is to guide the Forest Preserves in the development of its own Clean Energy Plan, aligned with that of Cook County, informed by available assets, and cognizant of Forest Preserve values related to preservation and protection of resident plants, wildlife, and their supporting habitats, while simultaneously providing for the enjoyment and recreation of the region's human citizens, now and in the future.

The guidance in this document is focused primarily on activities and decisions related to the County's "RENEW" track, though some consideration will be given to energy efficiency as included within the "REDUCE" track.

With regard to the County's "MAINTAIN" track, it should be noted that the Forest Preserves' Facilities & Fleet Maintenance Department are working with Cook County to identify an appropriate energy management system software to monitor and analyze building usage across preserve facilities. The aim is to use this software to drive better building operations and management practices to maximize efficient resource use.

In addition, the Forest Preserves' Planning & Development Department are hiring an Energy Manager in 2021 to spearhead energy monitoring, analyze use patterns and bills, negotiate energy procurement, and provide guidance on bill discrepancies, the data management

portal, benchmarking and data modeling. This service will support the Forest Preserve's goals to be fiscally responsible and reduce energy consumption.

With regard to the County's "SUPPORT" track, ISTC provides information within this document to assist the Forest Preserves in its own policy development process. ISTC will continue to provide resources and insights based upon its expertise and knowledge of procedures within peer organizations and may provide feedback on Forest Preserve policy drafts as part of its role in providing implementation assistance. See Appendix A: Sustainable Policy Resources for policy development considerations, resources, and connections to Sustainability & Climate Resiliency Plan objectives.

In addition to policy development, the Forest Preserves must make financial commitments to this goal in order to make achievement possible. Internal priorities will need to reflect this commitment or the Forest Preserves risks attaining both short and long-term emission reduction goals and resolutions. Further integration of technology in Forest Preserve facilities, such as remote-control lighting or utilizing a Building Automation System (BAS) will enable additional facility oversight and control opportunities to influence reductions in energy use.

It should be noted this plan only relates to facilities; it does not relate to the Forest Preserve's fleet. This too is consistent with the County's Clean Energy Plan, which briefly references fleet by identifying a short-term goal of "develop(ing) a strategy to reduce transportation emissions from Cook County operations and to transition away from fossil fueled vehicles." Despite exclusion in this format, addressing fleet emissions is a priority at the Forest Preserves. A Green Fleet Transition Plan is currently under development in collaboration with the University of Illinois at Chicago (UIC). The goal is for the Forest Preserves to run all its vehicles and equipment on green alternatives to gasoline and diesel fuels as resources become available, new and affordable technologies are produced, and existing vehicles and equipment are replaced. This involves purchasing only electric or hybrid vehicles, or those which have the capability of being retrofitted to run on propane and/or biofuels. In steps to transition its fleet of 385 vehicles, 2020 enabled the Forest Preserves to retire 25 gasoline or diesel vehicles, add 8 vehicles to its fleet of 24 alternative fueled vehicles, and source 16 new vehicles that will be outfitted for propane in 2021. UIC is working on a scale rating system for vehicles to provide a mathematical basis for decisions related to how and when to replace existing vehicles, as well as prioritization for the types of replacements considered.

The COVID-19 Pandemic Context

It should be noted that this framework was developed during the novel coronavirus (COVID-19) global pandemic, which necessitated Forest Preserve facility closures, reduced or altered services, and operational modifications to safeguard the health of staff members and the general public. Because the progression and resolution of the pandemic cannot be foreseen, it is understood that implementation of the Energy Roadmap set forth in this document, and installation of any renewable energy technology described here, may be delayed. It is recognized that some aspects of technology prioritization may need to be re-evaluated based on unforeseen impacts on Preserve operations. However, the Forest Preserves recognize the pandemic response as an opportunity to work through challenges once considered improbable and unsurmountable, and thus is itself an exercise in resiliency which will strengthen the ability to adapt to shifting conditions as our climate changes. Any need to re-evaluate or modify plans based on the evolution of the pandemic will be seen as an opportunity to hone resiliency skills and to gain insight into how a global crisis may impact local decisions.

EXISTING CONDITIONS

Current Initiatives

The Forest Preserves have always been progressive in terms of piloting sustainable technologies within its operations. At the time of this writing, the Forest Preserves have already incorporated renewable energy and efficiency technologies into its facilities and operations in the following ways:

- Built in 2009 as an all-electric building, the Little Red Schoolhouse Nature Center is a LEED Gold certified project, with a geothermal mechanical system.
- In 2011 Sagawau Environmental Learning Center was USGBC LEED Gold Certified
- Built in 2016 as an all-electric building, Swallow Cliff Pavilion is a LEED Silver-certified project, with rooftop solar panels.
- Built in 2017, the LEED Platinum certified Rolling Knolls Pavilion features rooftop solar panels, a geothermal heat exchange, high-performance insulation, high-efficiency windows, LED lighting and controls, and a Variable Refrigerant Flow (VRF) HVAC system.
- In terms of energy efficiency, bonds issued in 2019 are funding an initial phase of lighting system replacements and HVAC replacement at the Central Maintenance Compound–one of the Forest Preserves' largest utility users.
- In 2020 a bond was issued to support districtwide energy efficiency projects including LED lighting replacements, wireless remote-control systems and other energy saving building upgrades. The 2020 Capital Improvement Plan identifies needs for additional annual funding for 2021-2024 to continue this work at a few locations each year.
- The Forest Preserves have procured energy efficiency site assessments through utilities and consultants for a small portion of existing facilities to further identify energy savings opportunities and incentives and will invest in further assessments and prioritization in 2021.
- Construction of a new headquarters for Salt Creek Landscape Maintenance is scheduled to start in summer 2021. The specifications for the new building provide for "Net Zero Emissions-Readiness," defined as a building with infrastructure to allow future installation of an on-site photovoltaic system, enabling it to use no energy which results in GHG emissions at that time. An all-electric HVAC system with geothermal well heat-exchange is specified along with an exterior building envelope that well exceeds the code minimum insulation requirements to allow for reduction of the HVAC system size.
- A grant has been obtained to fund a solar project at Sagawau Environmental Learning Center.
- The Forest Preserves have contracted the purchase of wind renewable energy credits (RECs) from Constellation Energy to compensate for all 2020 electricity use.
- In 2021 the Forest Preserves, in partnership with Cook County, enter a 5-year agreement to purchase wind RECs from Constellation Energy to compensate for all electricity and electricity equivalent for natural gas. This arrangement allows both entities to obtain a better price for these commodities (because of shared purchasing volume) and for clean energy credits to be obtained based on annual usage. This sets a standard that should be adopted as a requirement henceforth: annually offsetting any energy emissions balance with renewable energy credits.
- In October 2020 the Forest Preserves Board of Directors approved adoption of the energy tracking software Cook County vetted and selected, enabling more consistent and efficient energy use tracking. Implementation is targeted to begin in 2021.

- As part of the Forest Preserves' efforts to restore land and maintain ecological health of habitat, recognition from the International Dark Skies Association is being pursued for approximately 12,000 acres of property, including the Little Red Schoolhouse Nature Center and Camp Bullfrog. This effort is a collaboration with the Adler Planetarium, and involves minimizing light pollution, or excessive use of artificial light, as well as dictating the type of light (including light color), where it is directed and when it is on, which can have consequences for wildlife health and behavior, as well as human visual discomfort. Light pollution leads to skyglow, or the brightening of the night sky over inhabited areas, which not only impacts wildlife behavior, but also the ability of human residents to view the stars and other aspects of the natural world at night. The lighting inventory involved with this effort may help identify opportunities to retrofit existing infrastructure with more efficient fixtures and better lighting controls.
- The Forest Preserves have engaged ISTC to complete meter-level energy use assessment, using data available from electricity provider, ComEd. This effort is detailed in the *Needs Assessment* section below.
- The Forest Preserves are exploring options for potential on-site solar development to generate sufficient electricity to achieve renewable energy and net-zero emissions targets, as well as a portion of a public sector partner's needs to achieve its analogous goals. This partnership is being pursued due to the amount of available land assets held by the Forest Preserves. See the *Needs Assessment* section below for further information, as well as *Appendix C: Solar Projection Models*.

The aforementioned Existing Conditions only relate to facilities.

Needs Assessment

The Forest Preserves operates 472 buildings throughout Cook County, 234 of which have electrical service, 99 of which have natural gas service and 15 of which use propane for a component of their facility operations. Natural gas, electricity and propane usage at all 234 of these facilities account for 66% of the Forest Preserves' total GHG emissions. Analysis of electricity usage data, available from the ComEd Business Energy Analyzer, revealed that a total of 3,867,252.53 kilowatt hours (kWh) of electricity, or nearly 4,000 megawatt hours (MWh), was used across Forest Preserve properties in 2019. Analysis of natural gas usage data, compiled from Nicor Gas, People's Gas and Centerpoint accounts, revealed that a total of 442,544.3 therms (thm) of natural gas was used across Forest Preserve properties in 2019. Analysis of propane usage data, compiled from AmeriGas bills, revealed that a total of 22,169.5 gallons of propane was used at these limited Forest Preserve properties in 2019.

See *Appendix B: Electricity, Natural Gas and Propane Usage* for monthly electrical usage in kWh, monthly natural gas usage in thm and monthly propane usage in gallons for each of the Forest Preserves' respective electricity, natural gas and propane accounts.

2030 Goal

To achieve the goal of 100% renewable electricity by 2030, it is necessary to begin by stating how much electricity must be generated via renewable energy technologies without any reduction in electricity usage via implementation of energy efficiency measures. This provides the maximum conceivable amount of renewable energy required to maintain Preserve operations at their current level. Knowing that the Forest Preserves are currently planning energy efficiency equipment upgrades and procedure modifications wherever feasible, and that the Forest Preserves intend to utilize the energy management system chosen by Cook County to monitor and adjust building energy use to maximize efficiency, it is reasonable to assume that 2019 electricity usage levels, 2019 natural gas usage levels and 2019 propane usage levels will represent a fair estimate of those "status quo," or baseline, electricity needs. Knowing the 2019 baseline will allow prioritization of implementation of both energy efficiency measures and renewable energy technologies so the 2030 100% renewable electricity goal can be met as quickly as possible, while minimizing costs and operational change burdens. Based upon the 2019 baseline, approximately 3,860 MWh of renewable electricity would be needed to achieve the Forest Preserve's goal of 100% renewable electricity.

From the 2019 usage data, ISTC identified the 10 largest electricity, natural gas and propane user accounts which represent the 51% of annual electricity usage, 55% of annual natural gas usage, and 97% of annual propane usage. These top 10 accounts are listed in respective "20% Reduction Projections" in *Appendix B: Electricity, Natural Gas and Propane Usage*. This information will allow efficiency efforts and renewable energy technology implementation to be focused first on properties associated with these high usage accounts, for the greatest impact on energy usage and greenhouse gas emissions. Based upon the 2019 baseline and these efficiency projections, approximately 3,458 MWh of renewable electricity would be needed to achieve the Forest Preserve's goal of 100% renewable electricity.

2050 Goal and Beyond

To achieve net zero energy, emissions from natural gas and propane usage must be accounted. An additional 2,613 MWh of renewable energy generation would be required to cover the emissions equivalent from facility natural gas and propane usage at the Preserve. Thus, a total of 6,470 MWh of renewable electricity generation would be needed to achieve the Forest Preserve's goal of net zero emissions by 2050.

There is intention for the Forest Preserves and a public sector partner to collaborate on exploration of strategies for joint solar development. The goal of the collaboration is to identify options for solar development to generate 6,470 MWh of electricity and electricity equivalent for natural gas and propane for the Forest Preserves and, potentially, after further legal and feasibility analysis, include approximately 10% of the renewable electricity generation needs of the public sector partner, or 23,650 MWh, for a total of 30,120 MWh of generation. The capabilities of meeting both partner needs will require further analysis than that initially explored here.

Solar photovoltaic installations and commitments are prevalent now than ever before, positioning the Forest Preserve and its public sector partner in good – and growing – company. From Wheeling's Indian Trails Library's 60 panels to the Northbrook Park District's Techny Prairie Activity Center's 833 panel installation, entities of varying priorities and facility sizes are venturing into energy generation. Reducing energy costs for its

residents and direct operational costs, public partners ranging from the Park District of Oak Pak to the Chicago Housing Authority seek the financial benefits for their constituents. Institutions of higher education continue to lead the way with multiple installations on City Colleges of Chicago campuses and lecture halls at the University of Illinois at Chicago, which aims to be a carbon neutral campus by 2050 through power purchase agreements, integrating solar power electricity generation into campus structures, and using environmental assets to generate and save energy. Evanston and Chicago have made commitments to source 100% clean, renewable electricity community-wide by 2030 and 2035, while River Forest has committed to sourcing 100% renewable energy by 2050, and many others feel heightening citizen pressure to follow suit. Additionally, over 130 municipalities across the Chicago region have committed to advancing renewable energy objectives as a part of the Metropolitan Mayors Caucus' Greenest Region Compact, the country's largest regional sustainability collaborative for municipalities.

As a land management agency that prioritizes stewardship, restoration and resiliency, the Forest Preserves seeks to epitomize these pillars in its pursuit of a solar development and brings these strengths, in addition to significant acreage, to the partnership with the public sector entity. A solar development could be explored on owned, undeveloped land, or acquisitional land, that is degraded, or not scheduled to be restored in the near future, enabling both installation and ownership of land prime for future restoration. Upon retirement of the panels (typical 20-year warranty and/or 25-30-year production lifespan) the Preserves could choose to restore the land for environmental or recreational purposes.

It is a priority for the Forest Preserve and many public sector partners to implement renewable energy technology solutions locally to support growth of both renewable energy infrastructure and renewable energy jobs. This should be welcomed by the two electric utilities of Forest Preserve territory as they are that are bound to the state's Renewable Portfolio Standard requirement of 25% by 2025-2026, with the 2020-2021 benchmark of 17.5%. For the 12 months ending June 30, 2020 ComEd renewable energy sources account for less than 5% of its electricity sources and Ameren Illinois renewable energy sources account for 13% of its electricity sources. Likewise, neither achieved - on time or 5-years late - the 2015-2016 requirement of photovoltaics to be 6% of the annual requirement.

Using the baseline 2019 electricity, natural gas and propane usage data, as described above, ISTC generated scenarios for solar electrical generation at various-sized developments. These scenarios are outlined in *Appendix C: Solar Projection Models.* Generation estimates are provided for 60-, 100-, 120- and 350-acre solar developments, both with no energy efficiency measures (i.e. at the 2019 baseline usage levels) and with a hypothetical but feasible 20% reduction in usage by the properties included in the 10 highest usage accounts for each electricity, natural gas and propane (i.e. with the implementation of some energy efficiency measures; this would translate to an overall 11.2% reduction in facility energy usage for the Forest Preserves). If energy efficiency projections were attained, or exceeded, 5,744 MWh or less of renewable electricity generation would be needed to achieve the Forest Preserve's goal of net zero emissions by 2050. This compares to 6,470 MWh if no efficiency measures are taken.

These projections compare the estimated amount of electricity which could be generated by these various-sized developments with needs of the Forest Preserves and the public sector partner. For example, the 60-acre scenario would

achieve the 2030 electricity emissions goal for the Forest Preserve, and exceed the 2050 net zero emissions goal. The 100-acre scenario would achieve the 2050 net zero emissions goal of the Forest Preserve, while addressing about 65% of the needs of the public sector partner. Projection models based upon the four solar development acreages were created to explore the possible impact of each on the Forest Preserves' ability to help expand on its mission of fostering a sustainable future for the region and assist the public sector partner in meeting its generation goals.

The Forest Preserves has reviewed these projections and are working with partners in the region to define options for potential solar development within the Preserves statutory framework, considering a combination of currently owned Preserve and public sector partner land, as well as scenarios that could incorporate new land acquisitions.

ENERGY ROADMAP FOR NET ZERO

Comparable Program Analysis

To orient the Forest Preserve's efforts with existing and emerging national trends, ISTC analyzed the renewable energy goals, policies and progress in municipalities and counties across the country. In particular, ISTC focused on communities included on the *Ready for 100* list compiled by the Sierra Club, comprised of over 160 cities, counties, and states across the U.S. that have goals to power their communities with 100% clean, renewable energy. Those cities and counties with a target year of 2025-2036 for their renewable energy goals were exclusively targeted as the experiences of these entities might be expected to be analogous to that of the Forest Preserves as they work to attain their goal of 100% renewable electricity by 2030. A brief online survey was developed, and an email was sent to the identified contacts at peer communities with a link to the survey, asking them to provide answers as a means of helping ISTC to learn about their successes, challenges, approaches to implementation, and any other relevant information which they would like to share. No reference was made to the Forest Preserves or Cook County. Please see Appendix D for full responses which includes information about respondent goals, roadblocks faced, types of renewable energy considered and other relevant details pertaining to implementation and perception of their goal.

The following themes emerged from responses received in terms of barriers to achieving renewable energy targets (see questions related to whether individuals are employed to work on these goals, pg. 66, and roadblocks encountered, pg. 68, in Appendix D). **These issues may be important for the Forest Preserves to address as they work toward their own renewable energy target,** particularly in terms of making the case, if necessary, for additional funding or staffing, and/or modification of strategies.

- **Limited staff capacity to support implementation.** Two communities indicated the involvement of volunteer boards, committees or advisory councils in renewable energy efforts. For the City of Keene, NH, one staff member provides support to the committee in addition to their other regular duties, and a consultant was hired on a short-term basis to assist with various aspects of planning, but no dedicated staff members are working on the goals. For East Pikeland Township, PA, only a volunteer Environmental Advisory Board are involved. Eight communities indicated that limited staff support was available, typically in the form of one or a few individuals who worked on the renewable energy goals in addition to other tasks. One community, the City of Fayetteville, AR, indicated that employees of the Arkansas Advanced Energy Association focus on this work, but upon checking that organization's online staff listing, it seems there is only one employee. It's unclear whether the nine members of the board of directors are directly involved and to what extent. When staff members must attend to renewable energy technology research, implementation and monitoring as one of a long list of duties, progress toward goals may be delayed or deprioritized if budget shortfalls or other unforeseen challenges arise. Lack of staffing may also present challenges to adequate baselining, making measurement of progress from any efforts difficult to characterize.
- **Lack of land for installation of renewable energy technologies.** This includes lack of land type appropriate for certain technologies, as well as lack of area.
- **Roadblocks presented by electrical utilities.** At least one community expressed doubts about being able to meet renewable electricity goals by 2030 unless the default electricity supply from the utility provider becomes 100% renewable by that target date.

- **Legislative barriers.** State legislation that preempts local requirements (e.g. state building code) was mentioned as a specific challenge by the City of Milwaukie, OR. Other respondents made generic comments about state legislatures presenting roadblocks. The Town of Breckenridge, CO stated that "before HB19-1003 was passed in 2019, Colorado solar gardens were limited to be built in the same or adjacent county as the subscriber, which is difficult for Breckenridge given our lack of flat, usable land in the mountains. Once HB19-1003 was passed, we were able to subscribe to community solar gardens that were located elsewhere."
- **Lack of funding or other cost considerations.** Respondents expressed issues related to limited budgets, costs of implementation, and concerns over anticipated administrative and regulatory filing fees that could make renewable energy rates unfavorable. The need for pooling purchasing power across multiple local governments was also mentioned.
- **Factors leading to increased electricity demand.** As noted above, the Town of Breckenridge, CO had been able to purchase solar power to cover the needs of municipal buildings, but the construction of a new water treatment plant would mean additional renewable energy must be purchased or generated to cover requirements.

Although they did not fill out the online survey distributed by ISTC, a representative from the City of Lowell, MA did reach out to ISTC to share their progress and express interest in lessons learned from other communities. The following is an excerpt from the Lowell, MA message, which reinforces the lack of staffing and funding barriers listed above. It also introduces an additional barrier—a lack of clear definition of renewable energy. This particular issue should not be a concern for the Forest Preserves, since Cook County has clearly defined what it deems acceptable to consider "renewable energy," and since the Forest Preserves will align their efforts with that definition.

"For the City of Lowell, the City Council passed a non-binding resolution brought forth by Mass Power Forward/Sierra Club. Since it was a non-binding resolution, it received unanimous support. However, the resolution did not include additional monetary commitments or other support resources to define/implement the goal. We have also experienced issues with defining exactly what 100% renewable means and so, we don't know how to measure the goal to ascertain when it might be achieved."

Prioritize Energy Conversation and Energy Efficiency Upgrades and Retrofits

Energy conservation and energy efficiency are accessible, readily available strategies for sustainability and climate resiliency planning and continuous improvement of equipment and facilities. While energy conservation and efficiency upgrades and retrofits alone will not achieve 100% net-zero GHG emission, these pillars are foundational opportunities within the pursuit. Transitioning existing operations to be fully supported by renewable energy will be easier to achieve if overall electricity, natural gas and propane requirements are minimized as much as possible through conservation and efficiency efforts. Local utilities and energy consultants offer on-site assessments, equipment and installation incentives, cost benefit analysis and support in implementing recommendations in order to make conservation efforts as turnkey as possible. These opportunities should be consistently and continuously pursued to maximize the energy conservation potential and the value of the services. Likewise, all newly constructed facilities must prioritize conservation, efficiency and on-site renewable energy where possible in design, build and day-to-day

operations. These approaches and practices must be codified as building standards.

As stated above, the 2020 Update to the Forest Preserves 5-Year Capital Improvement Plan proposed consultant support needs to inspect aging furnaces and boilers and exterior envelope needs at over 50 buildings. Some inspections with utility companies are anticipated and some capital funding has been allocated for consultant inspections for high priority buildings in 2021. Inspection results in support of both operational and energy use efficiency will be selectively and appropriately pursued.

The added consideration of public health benefits from energy conservation and efficiency allows for the alignment of everyday Preserve Operations with the Forest Preserve value of stewardship of natural resources in ways that also foster human well-being. In July 2019, the US EPA released *Public Health Benefits per kWh of Energy Efficiency and Renewable Energy in the United States: A Technical Report*, detailing "a set of values that help state and local government policymakers and other stakeholders estimate the monetized public health benefits of investments in energy efficiency and renewable energy. These benefits per kilowatt-hour (BPK) values are reasonable approximations of the health benefits of state energy efficiency and renewable energy investments that can be used for preliminary analysis when comparing across state and local policy scenarios." A flyer promoting the use of the BPK values included an example illustrating how to estimate the public health benefits of energy efficiency in Illinois. "According to the Energy Information Administration data, the incremental cost of the EE (energy efficiency) programs in Illinois in 2017 was approximately $430 million. The estimated health benefits generated by the EE program would therefore cover 20-50% of the costs using both the low and high BPK values."

Finally, energy conservation and efficiency measures can help decrease costs associated with deployment of renewable energy as measures will reduce the system sizes needed. All of these reasons, along with a desire to be consistent with the Cook County Clean Energy Plan, which includes energy reduction (efficiency in use) as the first of four activity tracks for achievement of the 100% renewable electricity and carbon neutrality goals, make it clear that energy conservation and efficiency must be a consideration in all Forest Preserve plans for clean energy and climate resiliency.

Commit to Electrification of Buildings New and Old

Acknowledging the environmental impact and social consequences natural gas extraction and usage presents, many states, cities and communities across the US are committing to phasing out natural gas usage by instating electric only building codes. The Forest Preserve needs to ensure all new construction is all electric, with no natural gas usage. This path has been pursued in recent buildings such as Swallow Cliff Pavilion and Little Red Schoolhouse Nature Center, is being pursued in new developments such as Salt Creek Landscape Maintenance, and should be codified in new Forest Preserve Green Building Standards to be developed in 2021-2022 with guidance from an energy consultant to be retained in 2021.

Inspection of aging furnaces and boilers and exterior envelope needs at up to 50 buildings is proposed in 2021 with support from a building energy consultant and electric and gas utility companies. Should equipment replacement needs be identified in inspection results it is highly recommended the Forest Preserves pursue any opportunity to pivot from equipment powered by natural gas, and propane, to that powered by electricity.

Energy Roadmap Context

The strategies which the Forest Preserves will use to achieve its goals for 100% renewable energy for use in its operations are similar to the four tracks outlined in the Cook County Clean Energy Plan (as referenced in the "County Context" section of this document's introduction), but are simplified to emphasize progress toward renewable energy goals. It is understood that the Preserves will work with Cook County on the "MAINTAIN" track as defined by the County. Changes to policies and procedures, as indicated within the County's "SUPPORT" track will necessarily be embedded within the Forest Preserves' continued efforts to achieve overall sustainability goals as outlined in its own Sustainability & Climate Resiliency Plan.

The three energy roadmap strategies include renewable energy technology "tiers." ISTC has characterized various renewable energy technologies into three tiers based on applicability, ease of implementation, and generation capacity. These tiers are defined later in the "Renewable Energy Technologies Prioritization" section.

Further, it must be recognized that these three energy roadmap strategies are complementary and meant to be enacted simultaneously, not in a linear, step-by-step fashion based upon their order of presentation below.

Finally, it is asserted that even when 100% renewable energy goals have been achieved, the Forest Preserves will continue to prioritize energy conversation and to continuously examine and reimagine their energy sourcing, as part of overall efforts to increase the sustainability and climate resiliency of operations.

Energy Roadmap Strategies

- **REDUCE:** Prioritize energy conversation through efficiency upgrades and retrofits. While these energy conservation practices are being implemented, the Preserves will continue to procure credits for off-site renewable energy. In other words, the initial steps in achieving 100% renewable energy goals for Preserve operations involve simultaneous energy conservation measures, along with purchase of Renewable Energy Certificates, to temporarily off-set the use of non-renewable energy until such time that widespread installation of renewable energy technologies on Preserve properties is possible.

- **RETHINK:** Reimagine electricity generation, fuel sources and land use capabilities by building and deploying, potentially in partnership with other stakeholders, low-carbon, large-scale Tier I technologies to offset energy consumption.

- **REPLACE:** Vet and select appropriate facility-scale Tier I, Tier II and Tier III renewable energy system technologies for on-site installation at Preserve facilities. Promote, seek funding and install renewable energy technologies on existing and new buildings to reduce need for energy from the grid and complete the transition to 100% renewable energy, replacing non-renewable energy sources entirely.

In order to reach emissions goals all significant, planned upgrades, retrofits, and proposed renewable energy installations must be integrated into, and prioritized in the Forest Preserves' Capital Improvement Plan. The 2020 Capital Improvement Plan, finalized in January

2020, covers 2020 to 2024 and is available online at https://fpdcc.com/downloads/plans/FPCC-2020-CIP-FINAL-010820.pdf. Roughly $6.8 million in new Construction & Development Funding was proposed for 2020, and it was acknowledged that capital needs continue to outpace available funding. This furthers the need to prioritize energy efficiency measures which ultimately provide energy cost savings. Energy efficiency and renewable energy technology projects, and relevant budget estimates, should be prepared by early fall of the year prior to planned implementation, to allow adequate time for administrative coordination and review of stated needs with each Preserve department.

RENEWABLE ENERGY TECHNOLOGIES PRIORITIZATION

The Forest Preserves have myriad options to explore in order to achieve 100% renewable electricity by 2030, and pursue net-zero emissions by 2050. Various combinations of these options could be pursued based on funding and other economic considerations, the context of similar efforts at the Cook County level, available labor, existing infrastructure, and other factors. The intent of this section is to help Forest Preserve staff prioritize technologies for possible implementation. As a reminder, and as outlined in the "Role of Energy Efficiency in Net Zero" section, the Forest Preserves should plan to identify opportunities for energy efficiency and implement those as soon as feasible to reduce overall energy requirements, while simultaneously pursuing renewable energy generation through these technologies.

The technologies described in *Appendix E: Analysis of Renewable Energy Technologies* are grouped into three tiers based on applicability, ease of implementation, generation capacity, and costs, as well as associated advantages and notes. With regard to renewable energy generation, Tier 1 technologies should be considered first, with technologies from Tiers 2 and 3 pursued in that order if additional renewable generation capacity is required. The tiers are defined as follows:

- **Tier 1** technologies are proven, increasingly implemented, and highly applicable, given the Forest Preserves' current assets and the context of countywide clean energy efforts, which would also have the greatest potential impact on achieving the 100% renewable electricity goal by the 2030 target date. These technologies are not necessarily the cheapest options, and some may be quite challenging from a legal, financial or political perspective. Pursuit of these technologies will still involve complex review, approval, and planning, and thus may require an extended period of time from initiation to full project implementation.

- **Tier 2** technologies are still proven and applicable, but may require additional funding, time and planning for implementation as compared to Tier I technologies. Tier II technologies may also be those with lower generation capacity that might be seen as supplemental strategies should implementation of Tier I technologies fall short of overall electricity requirements for Preserve operations.

- **Tier 3** technologies are emerging technologies which may not yet be available on the market, or which are not yet widely implemented, but might be considered now or in the future due to their potential in terms of stakeholder engagement or relation to some aspect of the Forest Preserves mission (e.g. minimal impact on wildlife or associated habitat).

Because they represent the highest priority renewable energy technologies to consider, Tier 1 technologies are described in detail below, along with applicability and cost considerations, as well as notes and advantages associated with implementation. Appendix E includes such detailed overviews for examples from all three technology tiers, together in one place for later reference.

TIER 1: ON-SITE RENEWABLE ENERGY TECHNOLOGIES

T1.1: Solar PV—Ground-mounted panels on Forest Preserve Property, owned by Forest Preserves

Photovoltaic (PV) system mounted on the ground which converts radiant heat and light from the sun into electricity. Components include PV modules, racking systems, cables, solar inverters and other electrical accessories.

Applicability	At strategic locations, smaller-scale installations of ground-mounted photovoltaic (PV) panels which convert radiant heat and light from the sun into electricity could meet needs for some of the Forest Preserves high-energy use facilities, and eventually, longer-term, be expanded to larger-scale installations to support energy use at multiple facilities. This strategy is particularly well-suited for the Forest Preserves because open land is an existing asset, and solar fields both large and small can be integrated into land and wildlife conservation efforts. It could also be used at some high-use locations such as the Central Maintenance Compound.
Cost	Costs will vary depending on size of installation, equipment used, grid connection complexities etc. EnergySage suggests that a 1 MW solar farm would cost roughly $1 million to install, which equates to $1.00/watt. Costs will include not only initial investment in equipment, construction, labor, permitting, and land (in the case of new acquisition), but also maintenance and end-of-life disposal. There may also be insurance costs.
Advantages	
● Land which is degraded, has low ecosystem services valuation, or is not slated to be restored for environmental or recreational value in the near future, could be targeted for solar installations. ● May allow benefits of new land acquisition to outweigh costs when considered as part of land management planning. ● Compatible with provision of pollinator habitat, which is also beneficial for various bird species and contributes to regional resiliency. Such solar site management can reduce erosion and stormwater runoff. IL is one of six states adopting pollinator-friendly solar standards, with the passing of the Illinois Pollinator-Friendly Solar Site Act in 2018. See the IDNR Solar Site Pollinator Score Card for guidance. ● Net metering could improve ROI ● Provides easily recognizable example of renewable energy efforts ● Large installations result in fewer systems needed to achieve goals, as well as decreased time spent in scoping, planning and permitting processes	

T1.2: Solar PV—Rooftop, traditional panels, owned by Forest Preserves

Photovoltaic (PV) system mounted on a building's roof which converts radiant heat and light from the sun into electricity. Components include PV modules, mounting systems, cables, solar inverters and other electrical accessories.

Applicability	Some rooftop solar systems are already in use by the Forest Preserves, including those at Swallow Cliff Pavilion and Rolling Knolls, and soon a system will be installed at Sagawau Environmental Learning Center thanks to a recently awarded grant. This strategy would make use of existing structures and provide electricity for direct use at facilities. As of 2019 the Forest Preserve's assets include over 200 roofed structures with electric connection.
Cost	Costs will vary depending on size of installation, equipment used, and whether the roof needs additional structural support. The solar installations at Swallow Cliff and Rolling Knolls cost on average $6,300/KW installed and where made possible through external grant funds. According to Energy Sage, as of August 2020 the average solar panel cost in Cook County, IL is $3.18/watt.
Advantages	
● Proven technology ● Does not require new land development ● Systems exist to integrate rooftop solar with LED lighting for buildings ● Net metering could improve ROI ● Provides easily recognizable example of renewable energy efforts	

T1.3: Geothermal—Heat pumps

Also known as a ground source heat pump, these systems transfer heat from the earth into a building during the winter and back into the ground during warmer months. Several types exist, including closed-loop, horizontal, vertical, etc. The Department of Energy offers details, guidance on choosing the proper system, and insights on operations and maintenance.

Applicability	Some geothermal systems are already in use by the Forest Preserves, including those at Little Red Schoolhouse and Rolling Knolls. Additionally, a system is slated for construction as part of the new Salt Creek Landscape Maintenance headquarters.
Cost	There are three main costs to consider: equipment, drilling and installation costs. Drilling and installation costs for a system make up about 65% of the total cost of a project. According to a Department of Energy Guide to Geothermal Heat Pumps, an average geothermal heat pump system costs about $2,500 per ton of capacity. For Rolling Knolls contractors quoted an average $123,040 increase in cost for geothermal and the Forest Preserve received $35,000 in grant funds for the project.
Advantages	
● Low operating costs ● High potential for energy use reduction, tying renewable energy efforts to efficiency efforts ● Works in any climate or weather condition	

T1.4: Solar PV—Canopies, or Carports

Ground-mounted elevated structures with PV panels integrated, which can provide shade. Frequently used in parking lots (creating a carport) or other paved areas.

Applicability	Multiple parking areas are available within the Forest Preserves footprint. Technology is infrequently used in Illinois thus far, although there are large Midwest installations, such as that at Michigan State University, validating applicability here.
Cost	According to EnergySage, 2020 national level pricing on solar carport installations cost $3.93 dollars per watt for systems averaging 11.3 kW in size.
Advantages	
● Efficient use of already developed space ● Provides shade/minimal protection from elements for space users; reduce heat island effects from paved surfaces; cooler cars when used for carports, which in turn could reduce need for AC and associated emissions and fuel consumption ● Potential enhancement of rainwater collection for landscaping ● Greater ability to tilt panels to maximize production, as compared to rooftop solar ● Could be integrated with electric vehicle charging stations for Forest Preserve staff, thus contributing to goals for a fleet fueled by renewable energy. Public EV charging stations would also foster sustainable behavior among patrons and be an easily recognizable commitment to net zero energy.	

T1.5: Solar Power Purchase Agreement (PPA), with a buy out provision, on Forest Preserve Property (Solar field or rooftop)

A financial agreement to purchase electricity generated by a specific solar energy project, on property owned by the Forest Preserves. Rather than owning photovoltaic equipment, a third-party would own and operate the system, while the Forest Preserves would pay for electricity. Should the agreement include a buyout provision, and to the extent allowed by the Forest Preserves' statutory framework, the Forest Preserves could purchase the installation after year 6 which allows the third-party to takes advantage of all incentives.

Applicability	This strategy would make use of Forest Preserve land assets or facility rooftops, decreasing costs of the PPA. The early buy out option enables the Forest Preserves to confidently purchase renewable energy for the first years of partnership, save funds for a few years and buy the installation after year 6 which allows the third-party to takes advantage of all incentives.
Cost	The partnership would define the cost per kWh of energy sourced from the project. This is a low expense as the third-party partner would pay costs of installation and be responsible for maintenance for the duration of the partnership. Should the buyout provision be exercised there is no price guarantee for the fair market value of a solar installation. Berkley National Laboratory's Utility-Scale Solar report - 2019 Edition states and showcases that in the Midwest utility scale solar PPAs have a levelized price near or below $40/MWh.
Advantages	
● Reduced costs both up-front and ongoing ● Any applicable rebates would go to the leasing company, potentially enabling a lower system cost at buy out ● Provides easily recognizable example of renewable energy efforts ● Compatible with provision of pollinator habitat, which is also beneficial for various bird species and contributes to regional resiliency (in the case of a solar field) ● Large installations result in fewer systems needed to achieve goals, as well as decreased time spent in scoping, planning and permitting processes ● Supports local renewable energy market development and local renewable energy jobs	

TIER 1: OFF-SITE RENEWABLE ENERGY TECHNOLOGIES

T1.6: Solar PV—Power Purchase Agreement for off-site system not on Forest Preserve Property

A financial agreement to purchase electricity generated by a specific solar energy project, not on property owned by the Forest Preserves. A third-party developer would own and operate the solar energy system and be responsible for installation, equipment purchase and maintenance.

Applicability	This can be an intermediate-term (10-12 years are shortest terms) option for meeting renewable energy targets until on-site solar generation can be achieved and may be used to supplement all forms of on-site renewable energy in the long-term in order to achieve net zero energy. Note the Cook County Clean Energy Plan indicates the County plans to use PPAs.
Cost	Berkley National Laboratory's Utility-Scale Solar report - 2019 Edition states and showcases that in the Midwest utility scale solar PPAs have a levelized price near or below $40/MWh.
Advantages	
● Can be rapidly implemented ● Typically electricity costs are more stable and are offered at a lower fixed rate than the utility's retail rate ● Low or no capital or maintenance costs or risks ● Third party developer could use tax credits, enabling lower pricing ● Can exclusively consider PPAs within certain jurisdictions, such as Cook County or Illinois, to align with priorities such as supporting local renewable energy market development and local renewable energy jobs. Sourcing a PPA with a solar farm in Nevada does not support these priorities	

T1.7: Wind—Power Purchase Agreement for off-site system not on Forest Preserve Property

A financial agreement to purchase electricity generated by a specific wind energy project, not on property owned by the Forest Preserves. A third-party developer would own and operate the wind energy system and be responsible for installation, equipment purchase and maintenance.

Applicability	This may be a short-term option for meeting renewable energy targets until broader scale on-site renewable generation can be achieved and may be used to supplement all forms of on-site renewable energy in the long-term in order to achieve net zero energy. Note the Cook County Clean Energy Plan indicates the County plans to use PPAs.
Cost	Berkeley National Laboratory's Wind Technologies Market Report offers a Wind Power Purchase Agreement (PPA) Prices dashboard with regional and execution date filters. Accordingly, wind PPAs in the Great Lakes region have a levelized price range of $22-$40/MWh, with most within the $30-$35/MWh range.
Advantages	
● Can be rapidly implemented ● Low or no capital or maintenance costs ● Limited risk ● Third party developer could use tax credits ● Predictability of electricity ● Cost stability ● Can exclusively consider PPAs within certain jurisdictions, such as Cook County or Illinois, to align with priorities such as supporting local renewable energy market development and local renewable energy jobs. Sourcing a PPA with a wind farm in Texas does not support these priorities.	

T1.8: Renewable Energy Credits (RECs)

As defined in the Cook County Clean Energy Plan, a REC is 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." RECs can come from various renewable energy sources that each have their own Advantages and drawbacks, and they can come from anywhere in the REC market, or a specific project.

Applicability	RECs can be a short, or long-term option for achieving renewable energy goals until the Forest Preserves can generate renewable energy on-site. In the future, the Forest Preserves might sell RECs to other entities if surplus energy is generated by its own on-site renewable generation.
Cost	The cost of RECs varies based on market dynamics and demand. According to the National Renewable Energy Laboratory's Status and Trends in the U.S. Voluntary Green Power Market (2017 Data) report, voluntary unbundled REC (purchased separate from utility) prices fell by more than 50% from 2014 to 2017, and increased from $0.31/MWh in August 2017 to $0.70/MWh in August 2018, though still remain below 2014 levels.
Advantages	
● Can assist with achievement of emissions goals while supporting the renewable energy market ● Low or no capital or maintenance costs ● Limited risk ● Can instate REC sourcing requirements (generation in Illinois vs. Midwest vs. domestic; wind vs solar, etc.) to align with priorities such as supporting local renewable energy market development and local renewable energy jobs. Sourcing RECs from California does not support with these priorities.	

NEXT STEPS TO NET ZERO

The following timelines were created to enable the Forest Preserve to achieve its energy reduction, renewable energy and net zero emissions goals, bearing in mind the recommendations and Energy Roadmap Strategies REDUCE, RETHINK and REPLACE outlined above, while working to revise, implement, and continuously improve its *Sustainability & Climate Resiliency Plan*. To actualize these goals and strategies, energy conservation and efficiency of the many existing facilities must to be prioritized and continuously pursued to reduce the existing operational footprint. On a parallel course, the concept of green building must be thoroughly explored, redefined and codified to embody building operations, ecosystem services and renewable-energy generation, fully encompassing the Preserves' values of environmental stewardship and fostering human well-being in any building upgrade or new building project. Simultaneously, the Forest Preserves must aggressively pursue vetting, selecting and on-going implementation of on-site renewable energy systems, coupled with a partnership pursuit of a large-scale installation, and sourcing of RECs to account for any emissions balances.

The collective dedication of many departments within the Forest Preserves make these greater goals possible and these focused initiatives achievable. The Forest Preserves will regularly re-examine the strategies and priorities included in this document to ensure that the residents of Cook County and the region's ecosystems are being best served. Progress towards these goals will be included in the Preserve's regular sustainability reports. Given the urgency of response to climate change and associated potential impacts on environmental and human health and well-being, the Forest Preserves are committed to leadership in sustainability, renewable energy sourcing, and carbon neutrality.

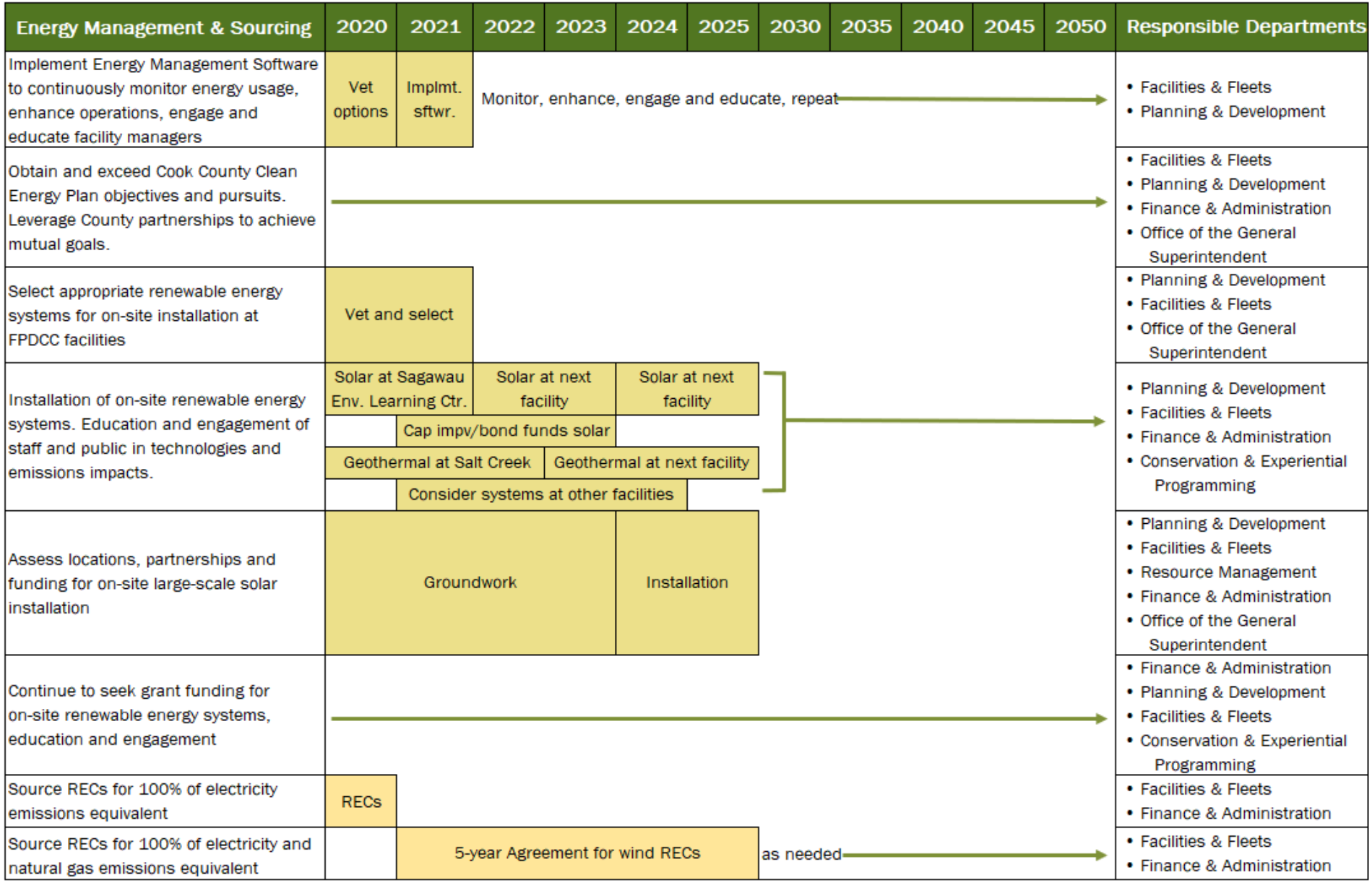
Net Zero Emissions Goals

Goals	2020	2025	2030	2035	2040	2045	2050
4.5% energy reduction annually preserve-wide	→	→	→	→	→	→	→
Reduce facility emissions by 45%			2030				
100% renewable electricity sourced			2030				
100% Resilient & Adaptable Lands						2045	
100% Carbon Neutral/Net Zero emissions							2050
Being Resilient in a Changing Climate	→	→	→	→	→	→	→

Net Zero Emissions Implementation Schedules

Energy Efficiency & Conservation Improvements	2020	2021	2022	2023	2024	2025	2030	2035	2040	2045	2050	Responsible Departments
Maximize use of utility incentives and assistance for energy efficiency and conservation improvements	→											• Finance & Administration • Facilities & Fleets
Continue to seek grant funding to support energy efficiency (EE) and conservation improvements, education and engagement	Crabtree Nature Center EE improvements		→									• Finance & Administration • Facilities & Fleets • Conservation & Experiential Programming
Hire, maximize capacity of Building Energy and Sustainability Consultant	Define projects to achieve goals											• Facilities & Fleets • Planning & Development • Finance & Administration • Human Resources
Capital improvement funds and bonds to support energy conservation and efficiency		Next Initiatives										• Facilities & Fleets • Planning & Development • Finance & Administration
Energy audits and renovation implementation in support of energy efficiency and conservation	Central Maintenance Garage					→						• Facilities & Fleets • Planning & Development • Finance & Administration
		General Headquarters			Next large user facility							
LED and RAB lightcloud lighting system upgrades	All Facilities											• Facilities & Fleets
Building Automation System sourcing and upgrading		All Facilities										• Facilities & Fleets • Planning & Development
Capital Improvement Plan building and equipment efficiency and conservation identification and funding	Furnaces, boilers, envelope improvements & audits					Allocate EE funding in plans: '25, '30, '35, '40 & '45						• Planning & Development • Facilities & Fleets

Green Building Practices	2020	2021	2022	2023	2024	2025	2030	2035	2040	2045	2050	Responsible Departments
Natural gas and propane equipment conversion to electricity or renewable energy systems	→	→	→	→	→	→	→	→	→			• Facilities & Fleets • Planning & Development
Staff continuing education on green building design, practices and management	→	→	→	→	→	→	→	→	→			• Planning & Development • Facilities & Fleets
Continue to seek grant funding to support green building efforts, education and engagement	→	→	→	→	→	→	→	→	→	→		• Finance & Administration • Planning & Development • Conservation & Experiential Programming
Maximize the use of utility incentives for green building design and construction	→	→	→	→	→	→	→	→	→	→	→	• Finance & Administration • Planning & Development
Net Zero Emissions Ready new construction	Salt Creek Maintenance	Salt Creek Maintenance	Salt Creek Maintenance	Next Facility	→	→	→	→	→	→	→	• Planning & Development • Finance & Administration
		Next Facility	Next Facility	Next Facility	Next Facility	Next Facility						
Redefine Green Building to include building operations, green infrastructure and ecosystem services of a building and its affiliated landscaping to align with Natural and Cultural Resources Master Plan goals and objectives		Redefine Green Building										• Resource Management • Planning & Development • Landscape Maintenance • Facilities & Fleets
Develop, implement and update Green Building Standards		Develop	Implement	Implement	Implement	Implement	Update	Impmt.	Update	Impmt.	Update	
Capital improvement funds and bonds to support redefined Green Building enhancements to existing buildings		GHQ	Next Enhancements	Next Enhancements	Next Enhancements	Next Enhancements						• Planning & Development • Facilities & Fleets • Resource Management • Finance & Administration


Energy Management & Sourcing
2020
2021
2022
2023
2024
2025
2030
2035
2040
2045
2050
Responsible Departments
Implement Energy Management Software to continuously monitor energy usage, enhance operations, engage and educate facility managers
Vet options
Implmt. sftwr.
Monitor, enhance, engage and educate, repeat
• Facilities & Fleets
• Planning & Development
Obtain and exceed Cook County Clean Energy Plan objectives and pursuits. Leverage County partnerships to achieve mutual goals.
• Facilities & Fleets
• Planning & Development
• Finance & Administration
• Office of the General Superintendent
Select appropriate renewable energy systems for on-site installation at FPDCC facilities
Vet and select
• Planning & Development
• Facilities & Fleets
• Office of the General Superintendent
Installation of on-site renewable energy systems. Education and engagement of staff and public in technologies and emissions impacts.
Solar at Sagawau Env. Learning Ctr.
Solar at next facility
Solar at next facility
Cap impv/bond funds solar
Geothermal at Salt Creek
Geothermal at next facility
Consider systems at other facilities
• Planning & Development
• Facilities & Fleets
• Finance & Administration
• Conservation & Experiential Programming
Assess locations, partnerships and funding for on-site large-scale solar installation
Groundwork
Installation
• Planning & Development
• Facilities & Fleets
• Resource Management
• Finance & Administration
• Office of the General Superintendent
Continue to seek grant funding for on-site renewable energy systems, education and engagement
• Finance & Administration
• Planning & Development
• Facilities & Fleets
• Conservation & Experiential Programming
Source RECs for 100% of electricity emissions equivalent
RECs
• Facilities & Fleets
• Finance & Administration
Source RECs for 100% of electricity and natural gas emissions equivalent
5-year Agreement for wind RECs
as needed
• Facilities & Fleets
• Finance & Administration

Reinforcement of Sustainability & Climate Resiliency Plan Objectives

Many Clean Energy Framework's Net Zero Emissions Implementation Schedules are validated and supported by the key objectives in the Sustainability & Climate Resiliency Plan.

Clean Energy Framework		Sustainability & Climate Resiliency Plan	
Focus Areas	Objectives	Focus Area	Objectives
All Categories	Capital improvement funds and bonds to support energy conservation and efficiency, redefined Green Building enhancements and installation of on-site renewable energy systems	Green Economies	Update the Reserve Funds Guidelines to include sustainability criteria
Energy Efficiency Audits & Conservation Improvements	Energy audits and renovation implementation in support of energy efficiency and conservation; Hire, maximize capacity of Building Energy and Sustainability Consultant; Capital Improvement Plan building and equipment efficiency and conservation identification and funding	Energy Use Tracking & Efficiency	Prioritize efficiency opportunities by buildings and utility consumption
			Complete energy audits of high priority sites
	Maximize use of utility incentives and assistance for energy efficiency and conservation improvements	Advancement	Increase Energy Rebates by 35%
		Water Use Tracking & Efficiency	Investigate efficiency upgrades and green water treatment at pools
	LED and RAB Lightcloud™ lighting system upgrades	Energy Use Tracking & Efficiency	Ensure all building sockets have LED appropriate fixtures
Green Building Practices	Redefine Green Building to include building operations, green infrastructure and ecosystem services of a building and its affiliated landscaping to align with Natural and Cultural Resources Master Plan goals and objectives	Water Use Tracking & Efficiency	Incorporate energy efficient and renewable energy technologies/systems into design and construction standards and equipment specifications where feasible
		Green Infrastructure Integration	Develop sustainable site standards for future landscape projects
		Transportation	Establish a water usage policy to improve water infrastructure through sound investments
	Develop, implement and update Green Building Standards; Staff continuing education on green building design, practices and management; Maximize the use of utility incentives for green building design and construction	Green Infrastructure Integration	Review and update green building standards for future projects
	Develop, implement and update Green Building Standards; Natural gas and propane equipment conversion to electricity or renewable energy systems; Staff continuing education on green building design, practices and management	Internal Operations	Evaluate and select environmentally preferred products and services and educate department buyers on approved green products
		Green Infrastructure Integration	Establish Green Purchasing Policy that prioritizes durable, reusable, recyclable, compostable and environmentally conscious goods and services
		Green Purchasing	Increase the purchase of environmentally preferable goods and services by 10%
	Develop, implement and update Green Building Standards; Staff continuing education on green building design, practices and management	Clean Energy Planning	Establish a solar energy policy
		Transportation	Install EV charging stations at previously identified locations when feasible
			Establish a Green Fleet Procurement Master Plan
		Green Purchasing	Reduce fuel usage by 4.5% each year
		Waste & Recycling	Expand Recycling Programs to all Forest Preserve Locations
		Energy Use Tracking & Efficiency	Reduce water consumption by 4.5% annually

Clean Energy Framework		Sustainability & Climate Resiliency Plan	
Focus Area	Objectives	Focus Area	Objectives
Energy Management & Sourcing	Hire, maximize capacity of Building Energy and Sustainability Consultant	Energy Use Tracking & Efficiency	Reduce energy consumption by 4.5% annually
			Implement an ongoing energy management program based on Energy Star guidelines
	Implement Energy Management Software to continuously monitor energy usage, enhance operations, engage and educate facility managers	Green Purchasing	Establish utility (electricity, waste, fuel, natural gas) baseline and tracking system
		GHG Emissions Measuring, Reporting & Reductions	Measure and publicly report progress to goals quarterly
	Assess locations, partnerships and funding for on-site large-scale solar installation	GHG Emissions Measuring, Reporting & Reductions	Reduce GHG emissions
		Transportation	Transition Fleet to run exclusively in renewable energy
	Obtain and exceed Cook County Clean Energy Plan objectives and pursuits. Leverage County partnerships to achieve mutual goals.	Advancement	Partner with municipalities to improve consistent practices and leverage resources
	Source RECs for 100% of electricity emissions equivalent	Clean Energy Planning	Establish an energy procurement policy to supply 20% of internal energy needs

RESOURCES

Glossary of Terms

Behind-the-Meter: On-site energy generation systems are considered generated behind-the-meter as the energy does not need to pass through an electric meter before reaching the end user. For example, the rooftop solar panels on Rolling Knolls Pavilion generate electricity behind the meter. Hypothetically, if the Forest Preserves had a large solar field on a property that sends all the electricity to the grid it is not considered behind the meter as the electricity must be metered and distributed in order to reach the end user.

Construction Disturbances: Construction of on-site renewable technologies can cause short-term disturbance to habitat via noise, erosion, soil compaction from equipment use, or need for land grading. The duration and severity of disturbances should be weighed against the ecosystem services of considered or selected sites.

Community Solar: A solar project shared by residents, businesses, non-profits and public facilities from the community who receive credit on their electricity bills for their portion of power produced by the project. Notable provisions limit. Community Solar in Illinois, the most relevant being the maximum project size of 2 MW, except no size limit for solar projects developed on brownfields, and no individual subscriber may own or lease more than 40% of a community solar project.

End-of-Life Recycling Options: Most renewable energy technologies have limited end-of-life recycling options, although options are actively being explored and developed across the globe. For example, there are very few places in the country that can recycle large, decommissioned, mainly fiberglass wind turbine blades. Increasingly, procurement options can be vetted by end-of-life recycling potential. The Green Electronics Council is developing an Electronic Procurement Environmental Assessment Tool (EPEAT) category for solar panels and other components*. Product criteria includes responsible end-of-life management, thus EPEAT should be consulted to identify panels with greater recyclability if solar PV is pursued. *The EPEAT category for PV modules and inverters will be released in September 2020.

Incentives: An array of incentives exist for many renewable energy technologies. Current incentives include federal, state, and utility incentives. Time is of the essence for many incentives as they aim to reward ‘early adopters’ and generate momentum to shift generation to renewables. The Federal government’s Business Energy Investment Tax Credit for example, applicable to Commercial, Industrial, Investor-Owned Utility, Cooperative Utilities, Agricultural sectors, sundown as follows:

FEDERAL BUSINESS ENERGY INVESTMENT TAX CREDIT (ITC), SOURCE

Technology	12/31 2020	12/31 2021	12/31 2022	12/31 2023	12/31 2024	12/31 2025	Future Years
Photovoltaic, Solar Water Heating, Solar Space Heating/Cooling, Solar Process Heat	26%	26%	26%	22%	22%	22%	10%
Hybrid Solar Lighting, Fuel Cells, Small Wind	26%	26%	26%	22%	N/A	N/A	N/A
Large Wind	18%	18%	N/A	N/A	N/A	N/A	N/A
Geothermal Heat Pumps, Microturbines, Combine Heat and Power Systems	10%	10%	10%	10%	N/A	N/A	N/A
Geothermal Electric	10%	10%	10%	10%	10%	10%	10%

Specific to solar, the Illinois Power Agency's SREC (defined below) incentives are organized by an Adjustable Block Program known as Illinois Shines. This program allocates a certain amount of SRECs to commercial soar, community solar and residential solar projects. As of April 7, 2021 there are waitlists for projects to attain SRECs incentives. Solar industry professionals anticipate approval of additional funding.

In ComEd and Ameren Illinois territory the DG Rebate – a one-time rebate payment of $250 per kW DC - is available to commercial and industrial (C&I) customers that take net metering service. To qualify, the PV system must be installed on-site, the system cannot not exceed 2,000 kW and a smart inverter must be installed on the system.

Net Metering, defined below, is also considered an incentive.

Interconnection: Interconnection consists of working through the electric utility company for permission to connect the renewable energy installation to the electric grid, so a project is 'on the grid'. See 'On the Grid' definition below. Interconnection requires the utility company to verify the safety and standards of the proposed renewable energy project, as well as evaluate its own infrastructure and capabilities to handle the anticipated generation. This may require infrastructure upgrades on the utility's behalf.

kWh: Kilowatt hour, a measure of electricity usage. One-thousand kilowatt hours equal one-megawatt hour. Renewable energy technologies are often measured in projected kWh of generation annually.

MTCO2e: Metric tons of carbon dioxide equivalent is the standard metric used when calculating greenhouse gas emissions.

MWh: Megawatt hour, a measure of electricity usage. One-megawatt hour equates to one-thousand kilowatt hours. Renewable energy technologies are often measured in projected MWh of generation annually.

Net Metering: Net metering enables non-utility renewable energy generators who are on the grid to earn credit on their bill when generating more energy than energy used, thus sending that energy to the grid for use elsewhere. This utility-based incentive is required by Illinois law, and benefits generators during peak generation times.

On the Grid: All renewable electricity projects are tied to the electric utility grid unless completely independent and 'off-grid'. Being on the grid enables an entity to utilize energy from the utility provider when their renewable energy technology is not providing all or any of the energy demanded, such as on cloudy or low-wind days. It is desirable for projects to be tied to the grid as

storage is not needed in this capacity and, economically it enables a project to both participate in net metering and earn REC incentives.

Off-Site Generation: Generation of renewable energy on land or facilities that do not consume the energy, but rather send the electricity back to the grid. Most common examples include large solar and wind fields.

On-Site Generation: Generation of renewable energy on land or facilities at the location where it is primarily consumed. On-site generation solar examples include installations on rooftops where electricity is needed by the building below, such as at Swallow Cliff Pavilion, or above parking space as a canopy/solar carport where electric vehicles can charge. Other renewable technologies can likewise be generated on-site to feed into existing facilities and operations.

Permitting: Each municipality instates processes and protocols to construct or amend built structures within its jurisdictions. Permitting extends to renewable energy projects. Many municipalities have recognized the importance of installing on-site renewable energy within their bounds thus have taken steps to ease, expedite and/or reduce costs of the permit process for select technologies. Chicago, for example, has created both a Green Elements Permit Process, as well as Chicago Solar Express specifically for rooftop solar. In other instances, renewable energy technologies are yet to be defined by municipal permitting departments, which has the potential to delay, increase costs, create roadblocks, or even prevent installation in a timely manner or at all.

Pollinator Friendly: A site management practice of housing native perennial vegetation and foraging habitat which is beneficial to pollinators and birds. Illinois is one of six states that has adopted pollinator-friendly solar standards, with the passing of the Illinois Pollinator-Friendly Solar Site Act in 2018. See the IDNR Solar Site Pollinator Score Card for guidance.

Power Purchase Agreement (PPA): A commonly used financial arrangement to purchase electricity from a specific renewable energy project owned by a third party. This third party will develop, own and operate the renewable energy system, take on responsibility for sourcing, installing and maintaining equipment, coordinating incentives, and 'selling' the anticipated power. In this arrangement the customer pays for some or all of the renewable energy at predetermined rates, enabling the customer to claim they are purchasing off-site renewable energy to offset their energy use. While the customer is not actually using said electricity, the equivalent amount of renewable energy is being generated and fed into the grid for use elsewhere. There are a few, notable advantages to PPAs. A sizable PPA can cover an organization's entire electricity load for years in one partnership. PPA partners typically qualify for the Federal Energy Investment Tax Credit, a valuable financial incentive for which the Forest Preserve does qualify not as a government entity (see Incentives defined above). A PPA can be located on an organization's property or an off-site property. Also known as an early buyout option, PPAs can include a provision enabling the customer to purchase the PV system at fair market value at any point during the life of the contract. Purchasing the system is most advantageous after the sixth year to incur all applicable incentives.

Reflective Surfaces Wildlife Hazards: The reflective surfaces of solar panels may mimic bodies of water and result in collision hazards for birds.

Renewable Energy Certificates (RECs): Often used interchangeably with Renewable Energy Credits, the Forest Preserves adopts the definition of "Renewable Energy Certificate (REC)" as outlined in the Cook County Clean

Energy Plan: '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. Buying and retiring RECs from a specific time period are what allow an energy user to claim to be using “green” or renewable energy for that time period. RECs are usually certified by a third-party organization such as Green-e or one of several regional REC tracking systems, which audit and verify the renewable aspects of the energy produced. RECs may be either "bundled" together with the purchase of electricity from a specific renewable energy project or sold separately from the electrons produced by the renewable energy source.'

Solar Renewable Energy Certificates (SRECs): Designation of renewable energy certificates corresponding to electricity generated by solar. The word ‘credits’ is often used interchangeably for ‘certificates’.

Storage: Saving excess energy for use later through means such as batteries. Storage complements many renewable energy technologies at an additional cost. At this point in time storage is often considered cost prohibitive, although storage technologies are expected to become more efficient and less expensive.

Wind Renewables Wildlife Hazards: Wind-based renewable energy technologies may impede on habitat and flight paths of birds and bats. Turbine height, blade length and strategic placement can correlate to the collision hazard.

Appendix A: Sustainable Policy Resources

The following is a list of policies the Forest Preserves may consider developing to support achievement of 100% renewable energy and net zero energy goals. Additionally, these policies support many objectives of the Sustainability & Climate Resiliency Plan and will further embed and reinforce sustainable practices. Many of these policies relate to each other and there will likely be overlap among them, thus it may be beneficial to consider development of "broader" policy types first (e.g. green building standards before water efficiency policies) so that the broader policies may be referenced within the more specific policies. There should be a mechanism to regularly review any sustainable policies to ensure they reflect the state-of-the-art (e.g. currently available product labeling/certification programs, available technologies, pushing the envelope in terms of energy efficient equipment and renewable energy requirements for contractors, etc.). Included are links to websites that might be of interest or provide additional information. However, Forest Preserves cannot guarantee that the information on these linked websites is accurate or current, and it may have moved or been revised since we created the link.

Green Investment Policy

Investopedia defines "green investments" as "investment activities that focus on companies or projects committed to the conservation of natural resources, the production and discovery of alternative energy sources, the implementation of clean air and water projects, or other environmentally conscious business practices. Green investments may fit under the umbrella of socially responsible investing (SRI), but they are fundamentally much more specific." This is related to green purchasing, although is listed separately because it also relates to green building and renovation, purchases of equipment upgrades necessary for water and energy efficiency, to expenditures related to infrastructure (e.g. a permeable parking surface or solar panels), and even to truly basic functions of the Forest Preserves, such as land acquisition and habitat restoration. It thus seems like the broadest of policy types, and might be best to develop earlier, rather than later. Additionally, such a policy might include investments made as part of employee retirement plans, insurance, IT, fundraising/revenue generation, etc.

Relevant objectives and focus areas in Sustainability & Climate Resiliency Plan

- Establish a Green Investment policy
- Update the Reserve Funds Guidelines to include sustainability criteria
- Reduce GHG emissions
- Establish a solar energy policy
- Establish a biomass utilization policy
- Establish an energy procurement policy to supply 20% of internal energy needs
- Develop sustainable site standards for future landscape projects
- Investigate efficiency upgrades and green water treatment at pools
- Establish a water usage policy to improve water infrastructure through sound investments

Examples & Resources

- Organisation for Economic Co-operation and Development (OECD) Investment for Green Growth: https://www.oecd.org/greengrowth/green.htm. Multiple resources of varying age, including resources related to climate, clean energy infrastructure and water infrastructure.
- Green Investment Group (UK organization) Green Investment Policy (2017): https://www.greeninvestmentgroup.com/assets/gig/who-we-are/our-impact-and-measurement/gig-green-investment-policy-2017.pdf. Includes evaluation of "green impact" and "green risk."
- Sustainable Investing Act: https://www.illinoistreasurer.gov/Local_Governments/Sustainable_Investing_Act. "The Sustainable Investing Act (PA 101-473) was spearheaded by Illinois Treasurer Frerichs and signed into law by Illinois Governor Pritzker in 2019 with an effective date of January 1, 2020. It provides that all state and local government entities that hold and manage public funds should integrate material, relevant, and useful sustainability factors into their policies, processes, and decision-making."

See also all references to relevant objectives stated in conjunction with other policies below.

Green Building Standards – New Construction and Renovation

Relevant objectives and focus areas in Sustainability & Climate Resiliency Plan

- Incorporate energy efficient and renewable energy technologies/systems into design and construction standards and equipment specifications where feasible
- Develop sustainable sites standards for future landscape projects
- Review and update green building standards for future projects

Examples & Resources

- US EPA compilation & comparison of standards: https://www.epa.gov/smartgrowth/green-building-standards
- ASHRAE GreenGuide: Design, Construction, and Operation of Sustainable Buildings, 5th Edition: https://www.ashrae.org/technical-resources/bookstore/ashrae-greenguide-the-design-construction-and-operation-of-sustainable-buildings
- LEED v4.1 Facility Maintenance and Renovation Policy Template: https://www.usgbc.org/resources/v41-mrp-facility-maintenance-and-renovation-policy-template
- The Sustainable Sites rating system and scorecard: http://www.sustainablesites.org/ and https://www.usgbc.org/resources/sites-rating-system-and-scorecard
- LEED Positive – Regenerative and restorative design vision - https://www.usgbc.org/programs/leed-positive
- US DOE Sample Contract Language for Construction Using Energy Efficient Products: https://www.energy.gov/sites/prod/files/2015/07/f24/construction_modellanguage.pdf
- National Institute of Standards and Technology's Building Life Cycle Cost (BLCC) Programs:

https://www.energy.gov/eere/femp/building-life-cycle-cost-programs

See also Energy Efficiency, Water Efficiency, Green Investment and General Procurement Policies and Contracting below.

Energy Efficiency Policy

This policy will be important for reducing the total energy required for Forest Preserve operations.

Relevant objectives and focus areas in Sustainability & Climate Resiliency Plan

- Establish utility (electricity, waste, fuel, natural gas) baseline and tracking system
- Prioritize efficiency opportunities by buildings and utility consumption
- Complete energy audits of high priority sites
- Reduce space heater usage by 20% per year
- Implement an internal communications system for quarterly utility consumption reporting
- Implement an ongoing energy management program based on Energy Star guidelines
- Establish an energy conservation policy
- Ensure all building sockets have LED appropriate fixtures
- Ensure all streetlights have LED appropriate fixtures
- Reduce energy consumption by 4.5% annually
- Investigate efficiency upgrades and green water treatment at pools

Examples & Resources

- US EPA & State and Local Climate and Energy Program—Energy Efficiency in Local Government Operations: https://www.epa.gov/sites/production/files/2015-08/documents/ee_municipal_operations.pdf
- US EPA ENERGY STAR Building Upgrade Manual: https://www.energystar.gov/buildings/tools-and-resources/building-upgrade-manual
- US DOE Facility Energy Management Guidelines and Criteria for Energy and Water Evaluations in Covered Facilities: https://www.energy.gov/sites/prod/files/2013/10/f3/eisa_s432_guidelines.pdf
- National Institute of Building Sciences Whole Building Design Guide: https://www.wbdg.org/
- US Green Building Council LEED for Operations and Maintenance: https://www.usgbc.org/leed/rating-systems/existing-buildings
- United States Conference of Mayors–Compilation of policies, incentives and ordinances to promote energy efficiency in existing buildings, sorted by city size; from 2018: http://www.usmayors.org/wp-content/uploads/2018/10/Existing-buildings.pdf
- Smart Energy Design Assistance Center (SEDAC) at the University of Illinois at Urbana-Champaign—Energy Efficiency Services: https://smartenergy.illinois.edu/energy-efficiency/

See also Green Building Standards, Water Efficiency, and Green Investment. Also, some overlap with General Procurement Policies and Contracting.

Water Efficiency Policy

Relevant objectives and focus areas in Sustainability & Climate Resiliency Plan

- Establish water usage baseline and tracking system
- Establish guidelines for water resource management
- Reduce water consumption by 4.5% annually
- Establish a water usage policy to improve water infrastructure through sound investments

Examples & Resources

- US DOE EERE Best Management Practices for Water Efficiency: https://www.energy.gov/eere/femp/best-management-practices-water-efficiency
- Alliance for Water Efficiency—Resource Library: https://www.allianceforwaterefficiency.org/resources
- Alliance for Water Efficiency—Water Conservation Tracking Tool: https://www.allianceforwaterefficiency.org/resources/topic/water-conservation-tracking-tool
- Whole Building Design Guide Best Practices for Comprehensive Water Management for Federal Facilities: https://www.wbdg.org/continuing-education/femp-courses/femp18
- US EPA Water Sense: https://www.epa.gov/watersense. Includes a product listing (https://lookforwatersense.epa.gov/products/) which could be integrated into purchasing policies.

See also Green Investment, Energy Efficiency and Green Building Standards. Also, some overlap with General Procurement Policies and Contracting.

General Procurement Policies and Contracting

Consideration to the embodied/embedded energy of goods and services procured by the Forest Preserves should be given. Purchasing policies may already include a preference for buying local/Illinois-made products. It may be worth referencing how such choices also impact the embodied/embedded energy of the good and services used by the Forest Preserves (reduced transportation impacts). Procurement policies may already include a preference for products with energy efficiency ratings (e.g. Energy Star certified, EPEAT registered, etc.). A review of existing policies to ensure that they reflect the most current energy efficiency labeling/certification programs is warranted. Wherever possible, purchase goods and equipment manufactured with less hazardous materials, recycled content and in facilities powered by renewable energy. Consider requiring vendors/contractors/service providers to use a minimum percentage of recycled content and/or renewable energy in their own operations.

Relevant objectives and focus areas in Sustainability & Climate Resiliency Plan

- Evaluate and select environmentally preferred products and services and educate department buyers on approved green products
- Establish Green Purchasing Policy that prioritizes durable, reusable, recyclable, compostable and environmentally conscious goods and services
- Establish policy and strategy to reduce usage of polystyrene foam, straws, and single-use plastics

- Establish ban on foamed polystyrene and plastic straws, both internally and their usage within Forest Preserves natural spaces
- Establish green printing and paper reduction practices
- Establish a Green Concessions Policy
- Increase the purchase of environmentally preferable goods and services by 10%

Examples & Resources

- LEED v4.1 Purchasing Policy Template: https://www.usgbc.org/resources/v41-mrp-purchasing-policy-template
- LEED v4.1 Green Cleaning Policy Template: https://www.usgbc.org/resources/v41-eqp-green-cleaning-policy-template
- EPEAT Registry: https://epeat.net/ Categories currently include computers & displays; imaging equipment; mobile phones; PV modules & inverters; servers; and TVs.
- Green Electronics Council (administers EPEAT registry)—Purchaser Contract Language: https://greenelectronicscouncil.org/resources-guidance/ Includes contract language and model policy language.
- Sustainable Purchasing Leadership Council—Sustainable Purchasing Program Policy: https://www.sustainablepurchasing.org/model-policy/. Click on the image of the sample policy to download. Deeper guidance and further resources are available in their "members only" community. See https://www.sustainablepurchasing.org/membership/ for membership information.
- Recycled-content
    - US EPA Comprehensive Procurement Guidelines (CPG) for Parks and Recreation Products: https://www.epa.gov/smm/comprehensive-procurement-guidelines-park-and-recreation-products
    - US EPA CPG for Construction Products: https://www.epa.gov/smm/comprehensive-procurement-guidelines-construction-products
    - US EPA CPG for Landscaping Products: https://www.epa.gov/smm/comprehensive-procurement-guidelines-landscaping-products
    - US EPA CPG for Miscellaneous Products: https://www.epa.gov/smm/comprehensive-procurement-guidelines-miscellaneous-products
    - US EPA CPG for Non-Paper Office Products: https://www.epa.gov/smm/comprehensive-procurement-guidelines-non-paper-office-products
    - US EPA CPG for Paper and Paper Products: https://www.epa.gov/smm/comprehensive-procurement-guidelines-paper-and-paper-products
    - US EPA CPG for Transportation Products: https://www.epa.gov/smm/comprehensive-procurement-guidelines-transportation-products
    - US EPA CPG for Vehicular Products: https://www.epa.gov/smm/comprehensive-procurement-guidelines-vehicular-products
    - CPG Product Supplier Directory: https://www.epa.gov/smm/comprehensive-procurement-guideline-cpg-program (scroll down for searchable listing)
- Responsible Purchasing Network (RPN)—Policies: http://www.responsiblepurchasing.org/resources/policies/index.php Compilation of examples at federal, state, county

and city levels, as well as examples from institutes of higher education. The most recent examples are from 2018 at the city level.

- Responsible Purchasing Network/Urban Sustainability Directors Cities Playbook (2016) and model language for sustainable procurement policies: http://www.responsiblepurchasing.org/purchasing_guides/playbook_for_cities/index.php
- RPN—See also the "Purchasing Guides" section of their web site, http://www.responsiblepurchasing.org/index.php
- US EPA Introduction to Ecolabels and Standards for Greener Products: https://www.epa.gov/greenerproducts/introduction-ecolabels-and-standards-greener-products
- US EPA Recommendations of Specifications, Standards, and Ecolabels for Federal Purchasing: https://www.epa.gov/greenerproducts/recommendations-specifications-standards-and-ecolabels-federal-purchasing
- Ecolabel Index—All ecolabels in the United States: http://www.ecolabelindex.com/ecolabels/?st=country,us
- Green Seal: https://greenseal.org/ and their certified product directory at https://greenseal.org/certified-products-services
- Underwriters Lab SPOT for professional purchasers: https://spot.ul.com/professional-purchasers/

New Equipment Purchasing

Wherever possible, purchasing equipment that is powered by, or is capable of being powered by, renewable energy, should be the preference. This should cover not only equipment used for maintenance of natural areas/landscaping (e.g. mowers, trimmers, etc.) but also items used for building maintenance (e.g. floor buffers, vacuums, steam cleaners, etc.) and to provide common services within buildings (e.g. HVAC, vending machines, ice machines, water fountains, electronic signage/digital displays, exit signs, etc.).

Relevant objectives and focus areas in Sustainability & Climate Resiliency Plan

- Incorporate energy efficient and renewable energy technologies/systems into design and construction standards and equipment specifications where feasible

Examples & Resources

- See above general procurement policy resources.
- LEED v4.1 Site Management Policy Template: https://www.usgbc.org/resources/v41-ssc-site-management-policy-template Includes considerations of reducing pollution from gasoline powered equipment.
- The GreenStation: https://thegreenstationproducts.com/ California-based company that provides electric lawn mowers and other landscape management equipment. Works with multiple Air Quality Management Districts in CA on gas-powered equipment exchanges for electric equipment.

Transportation – Fleet and Travel

In addition to requiring that new vehicles be powered by renewable fuels wherever possible (given regional fueling infrastructure), there should be requirements that Forest Preserve staff show preference for options powered by renewable energy and/or options with a reduced carbon footprint when traveling to conferences, meetings

and for other purposes related to their duties (e.g. take public transportation or carpool vs. individuals taking separate vehicles if such choice would not negatively impact travel/staff time or costs).

Relevant objectives and focus areas in Sustainability & Climate Resiliency Plan

- Establish a Green Fleet Procurement Master Plan
- Install EV charging stations at previously identified locations when feasible
- Transition Fleet to run exclusively in renewable energy
- Increase employee commuters' use of public transportation by 5%
- Reduce fuel usage by 4.5% each year

Examples & Resources

- GreenFleet Magazine article from 2014 on how to create a sustainable green fleet policy: https://www.greenfleetmagazine.com/155842/how-to-create-a-sustainable-green-fleet-policy
- Seattle Green Fleet Action Plan (2019): https://www.seattle.gov/Documents/Departments/FAS/FleetManagement/2019-Green-Fleet-Action-Plan.pdf
- Los Angeles Zero Emissions Roadmap 2.0 (2019): https://laincubator.org/roadmap/#roadmap
- City of Sacramento Fleet Sustainability Policy: https://www.cityofsacramento.org/-/media/Corporate/Files/Public-Works/Fleet/Fleet-Sustainability-Policy-121217/Fleet-Sustainability-Policy-121217.pdf?la=en
- Dublin, CA Green Fleet Policy (2012): https://dublin.ca.gov/DocumentCenter/View/8188/Green-Fleet-Policy----AP-30-2012-final?bidId=
- Green Fleet Awards: http://www.the100bestfleets.com/gf_about.htm
- City of Minneapolis Green Fleet Policy (2010): http://www2.minneapolismn.gov/www/groups/public/@council/documents/webcontent/convert_259214.pdf
- Why companies should introduce 'sustainable mobility' as an employee perk: https://thenextweb.com/shift/2020/10/15/why-companies-should-introduce-sustainable-mobility-as-an-employee-perk-syndication/
- SF Environment Sustainable Commuting: https://sfenvironment.org/sustainable-commuting
- County of Santa Barbara Clean Commute Program: https://www.countyofsb.org/hr/clean-commute.sbc

Appendix B: Electricity, Natural Gas & Propane Usage

Electricity Usage for 2019: This table details the actual electricity usage in kWh for each listed account for each month of 2019, the year on which solar projection models are based. All data was retrieved from the ComEd online dashboard by account number.

Account #	Account Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
1275708007	NC LRSH	45,794.03	38,772.76	35,507.51	25,132.78	27,640.46	23,717.34	26,957.80	23,488.69	21,642.41	23,017.30	32,736.93	37,442.15	361,850.15
5665331005	Maywood Complex	27,524.52	22,821.24	22,646.09	19,237.92	19,579.52	16,135.05	21,387.94	19,313.31	16,429.13	18,451.81	25,611.92	34,391.76	263,530.19
2743256002	Pools Whealan	12,479.30	9,801.08	9,700.90	8,857.14	17,873.26	35,961.26	45,340.82	33,914.28	15,320.91	9,193.55	10,062.18	9,624.57	218,129.26
2725745006	RM Wildlife	19,255.16	16,872.04	18,600.23	17,401.05	17,547.36	18,425.54	19,973.80	18,450.56	17,736.82	17,036.84	16,308.32	16,504.21	214,111.94
6141298004	GHQ	20,578.66	18,630.79	19,493.60	18,042.40	18,748.62	18,888.98	20,094.30	16,157.60	14,107.88	13,579.81	15,445.72	18,543.62	212,311.97
5529058003	Pools Cermak	16,921.09	14,911.50	13,861.69	9,646.92	11,090.60	21,193.27	24,369.29	22,942.04	5,166.60	7,171.30	12,896.51	14,410.64	174,581.46
1587133089	Pools Green Lake	4,768.98	3,765.98	3,545.19	2,367.08	10,186.42	29,900.38	33,519.03	30,231.57	6,868.09	5,087.61	5,755.39	7,282.91	143,278.64
0507761006	Camp Sullivan	12,422.31	15,606.39	15,232.25	10,731.58	10,142.07	10,195.41	14,675.38	10,379.48	9,138.86	9,522.78	12,140.57	11,836.65	142,023.73
0185195028	NC Sagawau	14,818.08	14,212.66	14,310.33	9,948.44	8,956.53	8,099.80	9,767.29	8,924.76	8,194.30	10,806.07	14,254.78	14,715.38	137,008.43
0283084202	Camp Bullfrog	14,840.71	13,484.56	14,650.75	13,878.64	7,199.53	7,698.83	8,220.62	7,962.15	7,402.68	9,035.92	10,834.31	10,270.94	125,479.65
3056360003	NC Crabtree	12,029.91	10,327.35	8,446.59	5,371.72	4,909.71	6,669.19	11,467.34	7,933.97	6,338.62	5,212.25	7,217.88	11,521.70	97,446.23
5999600015	Police Central	6,838.16	6,226.50	6,579.40	6,725.01	8,017.44	7,812.32	10,299.25	8,907.28	7,784.03	6,403.17	5,550.91	6,022.97	87,166.43
1522281000	PAV Swallow Cliff	13,516.00	12,748.37	10,756.46	5,849.46	2,343.41	1,811.99	1,799.84	2,200.10	2,309.17	3,047.94	9,581.43	13,447.63	79,411.79
3076107039	LM Palos Division	9,374.37	10,754.67	9,623.87	7,505.71	4,655.70	3,722.76	4,038.69	3,580.94	2,886.69	3,084.84	9,082.23	9,821.60	78,132.06
0073115143	RM Palos Crew	5,770.60	9,440.61	5,904.50	4,705.67	5,968.40	6,930.32	5,840.83	5,635.93	4,871.01	5,498.12	8,258.60	5,980.81	74,805.39
1438083107	Camp Reinberg	11,112.47	9,925.55	8,599.69	4,289.43	4,776.03	4,166.81	4,118.39	4,335.76	2,835.39	5,653.49	6,750.79	7,105.48	73,669.28
3483396017	Camp Dan Beard	7,865.02	9,788.85	8,150.31	5,705.38	3,152.95	2,342.06	2,068.57	2,425.51	2,447.74	3,712.34	8,760.77	8,789.99	65,209.50
4841153002	PAV VRC	5,156.66	5,208.02	4,540.01	4,238.62	4,470.76	4,033.96	6,126.40	5,947.79	5,148.64	6,390.01	6,679.79	6,831.35	64,772.03
0323032006	CS NW Busse	8,062.57	9,169.41	7,041.64	4,350.92	3,374.89	2,356.10	2,282.81	2,858.09	3,696.69	5,640.74	10,772.39	4,474.38	64,080.63
0137102133	PAV Rolling Knolls	16,018.55	6,386.21	6,416.75	3,719.00	6,556.92	3,328.96	2,446.57	2,189.24	2,077.24	3,246.49	5,077.41	4,945.13	62,408.48
3963170268	Boat Maple Lake	9,757.32	8,089.01	7,591.78	3,563.01	2,439.55	2,517.24	4,035.09	4,108.20	3,813.39	5,515.55	4,939.81	4,105.99	60,475.94

Account #	Account Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
8789155002	LM Cal Eggers	8,188.35	7,278.99	7,991.59	5,998.11	4,120.02	1,102.06	1,019.62	1,131.28	1,026.75	3,888.90	7,139.07	7,355.95	56,240.70
4143059003	NC River Trail	4,594.05	4,495.58	4,212.86	3,531.46	3,612.78	5,326.21	7,081.53	5,358.37	4,417.64	4,125.19	4,615.10	4,336.84	55,707.60
4931156039	LM NW Division	5,567.11	5,495.24	6,191.83	3,719.73	3,328.60	3,365.38	4,896.05	4,380.99	4,265.32	3,538.09	4,745.12	5,117.59	54,611.05
0129088133	RM Northwest Crew	5,444.00	5,678.30	5,450.65	4,417.58	3,362.86	2,327.47	4,844.46	4,241.65	3,405.40	2,829.14	4,644.33	5,215.86	51,861.69
9619074000	CS Cal	4,451.17	4,269.64	3,525.20	3,536.62	3,871.90	3,838.23	3,942.95	4,192.16	5,431.71	4,143.60	5,957.23	3,604.91	50,765.32
5783118011	LM Thorn Creek Division	5,611.05	4,786.44	4,605.51	3,137.38	2,969.52	3,111.80	3,690.77	3,557.82	3,473.07	3,780.45	5,041.77	5,158.52	48,924.08
5324263000	CEP Reinberg Storage	7,537.22	6,479.60	4,256.27	3,384.22	2,488.19	2,138.20	2,415.67	2,149.08	1,902.37	3,205.88	4,943.55	6,127.06	47,027.29
0171079217	Boat Busse	8,508.05	7,016.82	5,300.77	2,551.03	2,471.71	2,035.82	2,788.76	2,411.10	1,884.51	3,176.08	4,325.52	4,465.20	46,935.36
0893078030	Camp Shabbona	6,601.53	5,284.04	4,941.22	2,909.50	2,478.12	2,262.82	2,243.57	2,261.00	2,152.13	3,472.56	4,567.00	3,463.27	42,636.74
9286223004	LM Calumet Division	3,086.63	2,779.76	3,480.08	2,149.96	2,020.96	2,172.92	3,395.65	3,081.59	2,402.34	3,096.70	3,924.05	3,908.32	35,498.95
5805772020	CEP	5,868.72	4,293.39	2,565.23	1,203.47	1,414.27	2,051.52	3,631.67	2,499.56	2,141.23	1,835.47	3,835.09	3,966.05	35,305.65
2624678004	LM NB Division	3,931.39	4,139.79	3,909.63	2,072.93	1,836.87	2,104.41	3,151.52	2,513.53	1,998.89	1,725.97	3,120.30	4,340.07	34,845.29
4739144000	Deer Grove Sub Station	4,664.08	3,907.68	3,450.85	2,351.42	2,746.86	1,368.35	2,060.06	1,509.55	1,382.81	3,474.24	4,057.59	3,415.07	34,388.58
9712329004	Police SW	3,199.46	2,770.05	2,564.22	2,138.90	2,492.63	3,244.71	4,349.76	3,292.99	2,491.54	2,339.30	2,486.86	2,365.83	33,736.25
9712286004	RM Fisheries	3,303.60	3,424.49	3,893.78	2,294.61	1,129.00	1,840.50	4,250.46	3,050.34	2,115.82	1,562.42	2,156.38	4,239.65	33,261.05
0447750012	LM NW Rolling Knolls	318.36	524.19	4,639.04	7,344.82	5,497.50	40.51	50.03	45.59	45.38	49.08	4,408.55	7,730.47	30,693.51
0099033173	PAV Dan Ryan	4,619.14	3,953.34	2,985.76	2,212.10	2,357.83	2,065.21	2,940.67	2,341.02	1,947.89	1,507.76	1,739.52	1,772.93	30,443.17
2624671005	CS NB Bunker Hill	4,794.72	3,976.86	3,806.40	1,994.78	1,487.94	1,543.59	1,559.47	1,583.99	1,550.18	1,638.58	2,996.55	3,117.61	30,050.65
0591081006	LM Tinley Division	3,757.07	2,734.77	2,569.65	2,630.47	2,775.39	2,410.96	3,110.40	2,105.19	1,701.45	1,516.44	2,250.27	2,223.34	29,785.40
5469680005	NC Trailside	3,219.80	2,698.88	2,575.90	1,867.37	1,668.09	1,778.58	3,203.56	2,251.25	1,923.88	1,809.35	2,358.56	2,519.76	27,874.98
7088349005	LM SC Division	2,959.68	2,955.15	3,339.03	2,146.71	1,387.33	1,400.39	2,027.18	1,668.10	1,394.76	1,565.52	2,841.97	3,135.00	26,820.80
9712580007	Boat Tampier	698.50	2,060.09	3,172.49	3,182.57	3,059.77	2,718.27	4,018.23	3,286.12	2,193.72	842.59	918.38	509.48	26,660.19
1633581004	LM NB Skokie Sub Station	2,561.17	2,179.02	2,172.04	1,827.57	1,651.07	1,688.10	2,885.05	1,790.67	1,397.64	1,785.57	1,992.95	2,053.54	23,984.37
3807642005	LM IB Des Plaines Sub Station	2,512.58	2,196.92	2,285.79	1,963.33	2,034.13	2,219.86	2,675.47	1,753.47	1,505.10	1,103.71	1,266.19	1,455.44	22,972.01
2975134002	RM Skokie Crew	2,184.01	1,915.61	2,229.03	1,554.73	1,450.71	1,517.56	1,991.13	1,536.78	1,396.93	1,303.07	1,727.93	2,223.88	21,031.37
0597086032	RM Tinley Crew	1,842.39	2,340.04	1,902.40	1,136.10	1,034.03	1,072.90	1,672.55	1,420.47	1,065.52	1,322.43	2,730.95	3,402.09	20,941.87
4233097155	CS SC Bemis	1,100.58	1,116.27	1,296.60	1,277.35	1,413.63	1,824.06	2,464.81	2,047.95	1,676.02	1,492.30	3,009.49	1,397.57	20,116.62
1634059083	Police North	1,714.58	1,553.01	1,759.85	1,400.26	1,314.73	1,256.33	1,871.81	1,492.95	1,288.40	1,197.21	1,182.35	1,233.59	17,265.08

Account #	Account Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
1125175001	Police SE	1,647.59	1,469.58	1,333.43	993.09	1,185.09	1,495.07	1,785.97	1,789.29	1,572.43	994.61	1,337.49	1,334.90	16,938.54
2743258006	LM NB Caldwell	1,208.04	1,035.33	1,009.98	1,053.12	1,037.14	763.79	672.70	665.10	604.66	713.4925	808.06	836.15	10,407.55
3062791005	LM IB Division	2,489.60	881.11	944.06	626.19	463.33	509.90	996.37	964.83	830.25	588.28	356.18	383.94	10,034.04
0971170000	CS IB Sunset Bridge	2,190.21	1,769.29	1,252.12	306.87	129.78	164.38	70.54	50.90	49.73	51.57	1,666.53	1,416.16	9,118.06
0066054091	Police K9	714.84	606.69	565.59	420.93	600.19	795.11	1,431.27	765.65	593.02	422.96	499.62	526.28	7,942.14
3493215001	CS NB LaBagh	534.47	471.69	520.13	521.68	607.21	557.70	670.21	646.52	640.84	647.49	578.89	474.28	6,871.10
5163159050	Police NW	311.85	251.45	289.26	274.68	275.71	244.78	267.07	280.09	271.78	346.65	291.20	298.90	3,403.40
2130069002	CS NB Linne	92.15	52.86	0.00	71.81	212.28	456.42	474.87	478.17	471.63	500.83	219.99	29.53	3,060.54
6769118001	CS NB Forest Glen	272.66	284.67	315.2	273.24	266.65	256.27	258.39	261.20	252.67	268.09	242.10	54.97	3,006.10
6685169006	CS NB Hernandez	76.88	65.13	80.87	103.03	128.82	274.37	273.19	282.30	278.84	307.02	294.36	85.45	2,250.23
1351090019	CS IB Evans	42.78	7.06	7.86	59.48	68.93	70.19	70.15	63.97	60.79	64.37	457.13	19.51	992.22
1110291016	CS NB Harms North	52.41	47.83	51.36	79.88	123.98	138.15	130.79	136.75	116.18	82.96	9.45	1.03	970.77
3349150011	CS ThCk North Creek	20.11	19.37	17.24	57.30	106.32	99.51	104.73	82.82	77.03	80.10	141.72	10.21	816.46
1113083114	CS NW Barrington Rd	18.88	14.79	14.11	29.04	72.35	80.35	73.16	86.25	65.89	29.48	5.50	0.95	490.73
5247745003	CS SC Natl Grove	29.30	23.05	27.16	30.97	37.36	46.25	46.10	42.34	36.89	33.82	31.35	9.95	394.53
5075301035	LM SC Sledding Hill	169.01	0.10	0.13	0.05	0.03	0.01	0.03	0.02	0.01	0.08	0.12	0.12	169.69
2743257009	CS NB Caldwell	22.73	17.22	3.41	1.35	1.39	1.35	1.62	1.42	1.48	9.82	4.66	2.49	68.94
4841101008	CS NB Edgebrook	35.40	13.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	48.75

	January	February	March	April	May	June	July	August	September	October	November	December	All 2019 Total
Total (kWh)	417,672.3	376,278.1	358,705.1	272,105.7	272,423.1	301,687.8	370,390.1	317,439.4	231,718.7	244,777.2	340,645.6	363,409.5	3,867,252.53

Projection: 20% Reduction of Electricity Use

This table takes the top 10 accounts in terms of electricity usage from all active accounts in 2019 for the Forest Preserves and shows their total electricity usage. A 20% reduction in electricity use was then applied to these top electricity users to generate a new estimate of how much energy would be used and saved if this reduction were achieved.

Top 10 (used most kWh in 2019)														
Account #	Account Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
1275708007	**NC LRSH**	45,794.03	38,772.76	35,507.51	25,132.78	27,640.46	23,717.34	26,957.80	23,488.69	21,642.41	23,017.30	32,736.93	37,442.15	361,850.15
5665331005	**Maywood Complex**	27,524.52	22,821.24	22,646.09	19,237.92	19,579.52	16,135.05	21,387.94	19,313.31	16,429.13	18,451.81	25,611.92	34,391.76	263,530.19
2743256002	**Pools Whealan**	12,479.30	9,801.08	9,700.90	8,857.14	17,873.26	35,961.26	45,340.82	33,914.28	15,320.91	9,193.55	10,062.18	9,624.57	218,129.26
2725745006	**RM Wildlife**	19,255.16	16,872.04	18,600.23	17,401.05	17,547.36	18,425.54	19,973.80	18,450.56	17,736.82	17,036.84	16,308.32	16,504.21	214,111.94
6141298004	**GHQ**	20,578.66	18,630.79	19,493.60	18,042.40	18,748.62	18,888.98	20,094.30	16,157.60	14,107.88	13,579.81	15,445.72	18,543.62	212,311.97
5529058003	**Pools Cermak**	16,921.09	14,911.50	13,861.69	9,646.92	11,090.60	21,193.27	24,369.29	22,942.04	5,166.60	7,171.30	12,896.51	14,410.64	174,581.46
1587133089	**Pools Green Lake**	4,768.98	3,765.98	3,545.19	2,367.08	10,186.42	29,900.38	33,519.03	30,231.57	6,868.09	5,087.61	5,755.39	7,282.91	143,278.64
0507761006	**Camp Sullivan**	12,422.31	15,606.39	15,232.25	10,731.58	10,142.07	10,195.41	14,675.38	10,379.48	9,138.86	9,522.78	12,140.57	11,836.65	142,023.73
0185195028	**NC Sagawau**	14,818.08	14,212.66	14,310.33	9,948.44	8,956.53	8,099.80	9,767.29	8,924.76	8,194.30	10,806.07	14,254.78	14,715.38	137,008.43
0283084202	**Camp Bullfrog**	14,840.71	13,484.56	14,650.75	13,878.64	7,199.53	7,698.83	8,220.62	7,962.15	7,402.68	9,035.92	10,834.31	10,270.94	125,479.65

The top 10 accounts used 1,992,305,42 kWh which is 51.65**%** of all electricity used by the FPDCC in 2019.	1,992,305.42

	1,593,844.34
If the top 10 **reduced their electricity use by 20%** there would be a reduction of 398,461.08 kWh, which is **equivalent to reducing 10.33% from the total FPDCC kWh**. This would bring usage within these 10 accounts down to 1,593,844.34 kWh.	398,461.08

Natural Gas Usage for 2019

This table details the actual natural gas usage in therms for each listed account for each month of 2019, the year on which solar projection models are based.

Account #	Provider	Service Address	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
3588240000	Centerpoint	2199 S. 1st Ave	8528.68	7146.42	6079.62	4290.15	1215.92	565.94	0	0	0	16932.38	4854.03	9278.17	**58,891**
2502940000	Nicor Gas	6200 W Devon Av Chicago IL 60646	8180.89		381.98	2058.35		10757.8	10168.08	3002.24	2485.17		1195.48	1569	**39,799**
5488480000	Centerpoint	2199 1st Ave	6341.32	5313.58	4520.38	3189.85	904.08	474.06	0	0	0	1417.62	4065.97	7771.83	**33,999**
1146980000	Nicor Gas	536 N Harlem River Forest IL 60305	3320.47	5137.06	3968.27	2356.26	1143.87	420.79	114.4	35.39	102.11	319.46	2601	4163.08	**23,682**
2977461000	Nicor Gas	Ss Mccarthy Rd 1 E Will Cook Rd Palos Park IL 60464	894.93	1476.03	1126.23	11496.06	390.28	505.99	49.92	165.51	38.55	37.58	367.84	1086.79	**17,636**
741522000	Nicor Gas	12545 W 111th St Sag IL 60439	3036.35	3021.78	2979.78	1852.73	1369.71	362.02	383.41	104.13	39.82	234.69	818.68	2207.97	**16,411**
9964671000	Nicor Gas	Ns Palatine 1w Stover South Barrington IL 60010	2354.45	3302.2	2597.16	1032.59	808.41	136.02		45.43	45.47	556.08	1896.69	2202.83	**14,977**
9669870000	Nicor Gas	500 Ogden Ave Western Springs IL 60558	2523.02	2648.97	3323.97	1056.68	656.01				153.17	234.9	1348.05	1903.72	**13,848**
6642550000	Nicor Gas	Ns Willow Rd E Edens Hwy Northfield IL 60093	2465.98	2960.37	2234.81	1061.87	683	135.07	79.04	77.03	84.4	413.42	1614.52	2020.87	**13,830**
8000271000	Nicor Gas	14652 Oak Park Ave Oak Forest IL 60452	1775.52	1607.19	1710.85	461.19	621.91	250.63	172.69	99.28	247.85	484.94	1300.29	1440.02	**10,172**
7470649715	Nicor Gas	3500 S Rohlwing Rd Rolling Meadows IL 60008	1427.94	1931.71	1793.66	914.47		304.42	157.04	148.86		100.22	858.99	1524.02	**9,161**
9926809352	Nicor Gas	1100 River Oaks Dr Calumet City IL 60409	580.2	569.14				302.28	5546.48	88.53	1415.52	2.33	81.85	445.95	**9,032**
0608169963-00010	People's Gas	6100 N McClellan Ave Bldg, Chicago, IL	1334.1	1613	1180.5	632.5	501.7	57.4	21.9	18.8	36.5	306.2	933.2	1118.2	**7,754**
2984340000	Nicor Gas	2199 S 1st Ave Forest Park IL 60130	1074.33	1740.72	1399.22	953.92	467.1	349.1		26.02	10.42	16.7	495.33	1189.3	**7,722**
5862940000	Nicor Gas	6633 W Harts Rd Niles IL 60714	674.05	2012.68	1146.99	894.75	578.16	117.4	61.63	34.35	33.34	59.5	804.65	1163.15	**7,581**
9167190000	Nicor Gas	8800 W Belmont Ave Franklin Park IL 60131	1185.29	1799.89	1235.22	623.83	326.97	118.44	20.8	33.31	20.84	157.64	984.39	1025.08	**7,532**
0604864172-00001	People's Gas	1816 W 91st St Warehouse, Chicago, IL	1006.8	1553.8	1304.4	878.4	588.3	168.1	13.6	1	1	6.3	456.7	1261.3	**7,240**
6434861000	Nicor Gas	13800 S Harlem Ave Orland Park IL 60462	1129.29	1911.99	1030.73	503.43		177.66	2.08	19.77	3.12	180.61	773.3	1476.95	**7,209**

Account #	Provider	Service Address	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
7184890931	Nicor Gas	448 Thornton Lansing Rd Bldg 2 Lansing IL 60438	1028.11	1030.27	916.44	356.58	314.77	33.71	16.29	15.14	11.19	85.28	695.76	1079.17	**5,583**
6140761000	Nicor Gas	448 Thorton Lansing Rd Bldg 3 Lansing IL 60438	921.89	1308.91	804.45	462.94	340.46	55.06	38.48		18.75	187.92	640.58	785.54	**5,565**
6899260000	Nicor Gas	640 Cosman Rd Elk Grove Village IL 60007	1523.6			2475.2	87.11	26.74	1.16	2.32	23.31	19.86	521.53	839.22	**5,520**
4491986302	Nicor Gas	6797 W 147th St Oak Forest IL 60452	834.78	1506.13	778.5	453.6		219.22	5.2	31.23	5.21	143.02	638.49	821.11	**5,436**
3771980000	Nicor Gas	Ns Chicago 1m W River Forest IL 60305	979.96	1352.51		1097.16				241.51	0	67.86	660.44	873.41	**5,273**
6428351000	Nicor Gas	3302 Ashland Ave Maint Bldg Steger IL 60475	1178.03	614.49	1173.97	339.42	798.22	134.03	163.28		15.63	41.76	268.56	533.46	**5,261**
0608169963-00011	People's Gas	6340 W Devon Ave Bldg, Chicago, IL	772	976.6	693.3	597.1	502.7	150.3	12.5	9.4	11.5	104.5	497.4	615.5	**4,943**
4231980000	Nicor Gas	738 Thatcher Ave River Forest IL 60305	762.19	1102.35	910.32	416.23	254.31	16.62	23.92	12.49	20.84	79.34	564.3	698.72	**4,862**
866072013	Nicor Gas	1 Aloha Ln Westchester IL 60523	720.71	924.85	843.89	296.86	236.66	31.17	14.56	12.49	10.42	130.5	609.23	731.15	**4,562**
7284450000	Nicor Gas	1140 Harms Rd S Lake Glenview IL 60025	260.28	799.26		1945.21	126.63	23.89	3.12	9.36	14.58	212.97	416.95	721.74	**4,534**
3877251000	Nicor Gas	Es Paxton 1s 158th Dolton IL 60419	1249.58		1786.39							16.7	396.72	1062.73	**4,512**
769870000	Nicor Gas	500 Ogden Western Springs IL 60558	699.97	960.15	1121.04	383.02	118.33	61.3	6.24	20.82	29.17	87.69	326.04	653.75	**4,468**
3730370000	Nicor Gas	Es Quentin Rd Dining Hall Palatine IL 60067	706.19	842.85	733.86	353.95	231.47	77.92	59.28	82.23	59.39	160.77	515.18	624.46	**4,448**
7669870000	Nicor Gas	500 Ogden Ave Western Springs IL 60558	478.05	623.83	739.05	271.95	449.45	157.92	84.24	104.1	119.83	242.2	511	556.47	**4,338**
6804351000	Nicor Gas	18725 Stoney Island Av Garage/Maint 2nd Fl Lansing IL 60438	716.56	964.3	662.24	335.27	180.61	32.2	37.44		8.33	115.88	591.47	601.45	**4,246**
2671180000	Nicor Gas	2401 17th Av North Riverside IL 60546	963.37	1141.8						727.65	19.79	70.99	618.64	684.08	**4,226**
1250761000	Nicor Gas	448 Thornton Lansing Rd Bldg 1 Lansing IL 60438	722.78	832.47	674.7	304.13	271.95	35.42	109.62			109.62	500.55	625.5	**4,187**
6671180000	Nicor Gas	2401 17th St North Riverside IL 60546	677.16	801.33	592.69	317.62	184.76	25.97	13.52	139.49	11.46	106.48	536.08	712.32	**4,119**
3062871000	Nicor Gas	Ns Golf 1e Bartlett Streamwood IL 60107	401.49	917.6	715.49	470.14	257.85	267.4	26.76	16.3	17.48	137.85	294.67	529.05	**4,052**
7236270000	Nicor Gas	3120 Milwaukee Ave Northbrook IL 60062	613.9	865.69	805.48	500.31		237.93	35.36	6.24	20.84	38.62	293.64	435.13	**3,853**
2494450000	Nicor Gas	1146 Harms Rd Glenview IL 60025	661.6	674.7	471.25	270.91	315.12					312.12	515.18	536.59	**3,757**

Account #	Provider	Service Address	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
4917270000	Nicor Gas	803 N River Rd Mount Prospect IL 60056	612.86	802.37	578.16	294.79	173.34	176.63	14.56	13.53	14.58	92.91	411.73	488.48	**3,674**
7434861000	Nicor Gas	13800 S Harlem Ave K9 Bldg Orland Park IL 60462	583.83	690.27	534.57	251.19	169.19	29.09	30.16	40.59	33.34	110.66	379.33	491.62	**3,344**
1890370000	Nicor Gas	Ns Dundee 1e Smith Palatine IL 60067	654.34	562.59	544.95	266.76	158.81	15.58	1.04	1.04	1.04	113.79	246.62	462.33	**3,029**
0608169963-00003	People's Gas	2300 W 87th St Bldg, Chicago, IL	494.6	455.5	513.2	393.9	268.1	110.7	0	0	0	0	191.2	518.3	**2,946**
0601413928-00001	People's Gas	1818 W 91st St Bldg, Chicago, IL	484.2	635.4	566.3	48.4	313.9	97.1	24	5.2	9.4	12.5	237.2	504.7	**2,938**
3452871000	Nicor Gas	3100 N Golf RD Streamwood IL 60107	386.8	583.35	485.78	254.31	177.49	47.79	32.24	24.98	25	30.27	184.96	414.21	**2,647**
0608169963-00005	People's Gas	8601 S Western Ave Bldg, Chicago, IL	366.8	442	414.3	263.6	153.3	39.7	7.3	0	0	0	136.9	401.3	**2,225**
4889043511	Nicor Gas	2401 17th St North Riverside IL 60546	358.8	420.39	314.51	179.57	106.91	31.17	22.88	21.86	21.88	59.5	238.26	280.32	**2,056**
2358601566	Nicor Gas	448 Thornton Lansing Rd Bldg 1 Caretaker Lansing IL 60438	324.58	292.71	246	108.99	134.94	21.81	17.68	15.61	42.72	39.67	249.75	286.6	**1,781**
2146980000	Nicor Gas	536 N Harlem River Forest IL 60305	205.32	323.85	243.93	173.34	70.58	19.74	7.28	2.08	7.29	43.84	158.84	197.69	**1,454**
8530360000	Nicor Gas	640 Cosman Rd Elk Grove Village IL 60007	207.4	252.23	369.52	79.92	99.64	4.15	5.2	0	0	39.67	163.02	182	**1,403**
7838158431	Nicor Gas	8800 W Belmont Av 2 Franklin Park IL 60131		149.47	215.9	26.98	60.2	30.13	8.32	12.49	16.67	156.6	307.23	268.82	**1,253**
9081640000	Nicor Gas	6200 W Devon Ave Chicago IL 60646	221.91	242.89	293.75	102.76	112.1		7.28	0	1.04	4.17	227.81		**1,214**
5236270000	Nicor Gas	3116 Milwaukee Ave Northbrook IL 60062	245.76	124.56	249.12	159.85	113.14	37.4		18.73	20.84	27.14	115.99	82.63	**1,195**
8092067297	Nicor Gas	Ns Palatine Rd 1w Stover Rd #2 Barrington Hills IL 60010	171.1	234.58	25.95	73.69	21.79	9.35	5.2	4.16	6.25	37.58	130.62	165.26	**886**
9530360000	Nicor Gas	640 Cosman Rd Elk Grove Village IL 60007	268.58	173.34	55.01	61.24	21.79	14.54	13.52	9.36	12.5	28.18	98.23	122.38	**879**
0608169963-00007	People's Gas	2301 W 83rd St Bldg 4, Chicago, IL	281.6	139.4	135.3	97.9	70.9	68.8	0	0	0	0	0	56.4	**850**
1882533494	Nicor Gas	31w355 Bode Rd Apt 2 Elgin IL 60120	323.85	195.14	38.66								38.66	190.37	**787**
3023578295	Nicor Gas	Es Freeman Rd 2s Algonquin South Barrington IL 60010	286.21		130.78		98.61	35.32	28.08	26.02	30.21	51.15		65.89	**752**
5389978830	Nicor Gas	3302 Ashland Ave FL 2 Steger IL 60475	134.81		193.06	127.67	71.62	18.7	7.28	0	5.21	0	58.52	120.29	**737**

Account #	Provider	Service Address	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
5610731000	Nicor Gas	Ss 131st St 1w Wolf Rd Palos Park IL 60464											193.32	437.22	**631**
6220313967	Nicor Gas	31w355 Bode Rd Unit 1 Elgin IL 60120	50.81	72.66	280.26									1.04	**405**
5243936501	Nicor Gas	18725 Stoney Island Av Lansing IL 60438	139.99	141	71.62							0			**353**
9630370000	Nicor Gas	Es Quentin Rd 2n Dundee Rd Pump & Utility Palatine IL 60067	65.33	88.23		40.48		11.42	0	0	0	9.39	40.75	53.34	**309**
1662125096	Nicor Gas	1100 W Ogden Ave Bldg 1-warming Hse Western Springs IL 60558	30.07	38.4	34.25	19.72	13.49	8.31	7.28	6.24	7.29	9.39	24.03	28.24	**227**
8907031005	Nicor Gas	7600 Ogden Ave Lyons IL 60534	0		0		0	2.07	92.47	0	35.42		62.64	0	**193**
2841491876	Nicor Gas	3120 Milwaukee Ave(Residence) Northbrook IL 60062												108.78	**109**
505466836	Nicor Gas	801 N River Rd Mount Prospect IL 60056		14.53				14.54	19.76						**49**
1939346963	Nicor Gas	15940 S CENTRAL Tinley Park IL 60477													**0**
2446762704	Nicor Gas	6665 W Harts Rd Niles IL 60714	0	0	0	0	0	0	0	0	0	0	0	0	**0**
0608169963-00008	People's Gas	2301 W 83rd St Bldg 1, Chicago, IL	0	0	0	0	0	0	0	0	0	0	0	0	**0**
0608169963-00006	People's Gas	2301 W 83rd St Bldg 3, Chicago, IL	0	0	0	0	0	0	0	0	0	0	0	0	**0**
0608169963-00004	People's Gas	2301 W 83rd St Bldg 2, Chicago, IL	0	0	0	0	0	0	0	0	0	0	0	0	**0**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Total thm	**71,605**	**71,061**	**58,972**	**48,930**	**17,336**	**17,634**	**17,794**	**5,532**	**5,426**	**24,799**	**39,959**	**63,497**	**442,544**

Projection: 20% Reduction of Natural Gas Use

This table takes the top 10 accounts in terms of natural gas usage from all active accounts in 2019 for the Forest Preserves and shows their total natural gas usage. A 20% reduction in natural gas use was then applied to these top users to generate a new estimate of how much energy would be used and saved if this reduction were achieved.

Top 10 (used most thm in 2019)															
Account #	Provider	Address	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
3588240000	Centerpoint	2199 S. 1st Ave	8528.68	7146.42	6079.62	4290.15	1215.92	565.94	0	0	0	16932.38	4854.03	9278.17	58,891
2502940000	Nicor Gas	6200 W Devon Av Chicago IL 60646	8180.89		381.98	2058.35		10757.8	10168.08	3002.24	2485.17		1195.48	1569	39,799
5488480000	Centerpoint	2199 1st Ave	6341.32	5313.58	4520.38	3189.85	904.08	474.06	0	0	0	1417.62	4065.97	7771.83	33,999
1146980000	Nicor Gas	536 N Harlem River Forest IL 60305	3320.47	5137.06	3968.27	2356.26	1143.87	420.79	114.4	35.39	102.11	319.46	2601	4163.08	23,682
2977461000	Nicor Gas	Ss Mccarthy Rd 1 E Will Cook Rd Palos Park IL 60464	894.93	1476.03	1126.23	11496.06	390.28	505.99	49.92	165.51	38.55	37.58	367.84	1086.79	17,636
741522000	Nicor Gas	12545 W 111th St Sag IL 60439	3036.35	3021.78	2979.78	1852.73	1369.71	362.02	383.41	104.13	39.82	234.69	818.68	2207.97	16,411
9964671000	Nicor Gas	Ns Palatine 1w Stover South Barrington IL 60010	2354.45	3302.2	2597.16	1032.59	808.41	136.02		45.43	45.47	556.08	1896.69	2202.83	14,977
9669870000	Nicor Gas	500 Ogden Ave Western Springs IL 60558	2523.02	2648.97	3323.97	1056.68	656.01				153.17	234.9	1348.05	1903.72	13,848
6642550000	Nicor Gas	Ns Willow Rd E Edens Hwy Northfield IL 60093	2465.98	2960.37	2234.81	1061.87	683	135.07	79.04	77.03	84.4	413.42	1614.52	2020.87	13,830
8000271000	Nicor Gas	14652 Oak Park Ave Oak Forest IL 60452	1,775.52	1,607.19	1,710.85	461.19	621.91	250.63	172.69	99.28	247.85	484.94	1,300.29	1,440.02	10,172.36

The top 10 accounts used 243,246.5 thm which is 54.97**%** of all natural gas used by the FPDCC in 2019.	243,246.49

If the top 10 **reduced their natural gas use by 20%** there would be a reduction of 48,649.3 thm, which is **equivalent to reducing 11.51% from the total FPDCC thm**. This would bring usage within these 10 accounts down to 194,597.2 thm.	194,597.19
	48,649.30

Facility Propane Usage for 2019

This table details the actual propane usage in gallons for each listed account for each month of 2019, the year on which solar projection models are based.

Account #	Account Name	January	February	March	April	May	June	July	August	September	October	November	December	TOTAL
202354651	RM - Fisheries - house	772.80	425.50	-	-	-	-	-	-	-	215.70	-	-	1,414.00
202354651	RM - Fisheries - garage	693.10	383.10	119.40	-	93.50	-	-	-	-	26.20	-	-	1,315.30
202354651	Camp - Shabbona	287.10	221.80	-	130.70	-	-	-	-	-	-	-	256.50	896.10
202354651	Camp Bullfrog - Office	325.10	352.60	150.20	-	-	-	-	-	-	-	-	600.50	1,428.40
202354651	Camp Bullfrog - Cabin 1	250.30	-	-	-	-	-	-	-	-	-	-	46.70	297.00
202354651	Camp Bullfrog - TS-1	200.60	350.10	-	-	-	550.60	-	-	-	-	-	594.30	1,695.60
202354651	Camp Bullfrog	-	-	-	-	-	-	-	-	-	-	-	350.20	350.20
202354651	LRSH Nature Center	150.30	450.30	501.60	306.50	-	-	-	-	-	325.20	-	-	1,733.90
202354651	RM - Palos	1,500.90	1,603.20	-	580.80	450.30	-	-	-	-	1,001.70	-	1,101.20	6,238.10
202354651	RM - Palos	1,126.60	850.40	855.40	200.00	-	-	-	-	-	201.50	-	93.20	3,327.10
202354651	LM - Palos	525.30	502.40	-	540.80	-	-	-	-	-	250.30	-	161.90	1,980.70
202354651	Camp - Dan Beard	245.20	399.90	-	350.00	-	-	-	-	-	498.00	-	-	1,493.10

	January	February	March	April	May	June	July	August	September	October	November	December	All 2019 Total
Totals (gallons)	6,077.30	5,539.30	1,626.60	2,108.80	543.80	550.60	-	-	-	2,518.60	-	3,204.50	22,169.50

Projection: 20% Reduction of Propane Use

This table takes the top 10 accounts in terms of propane usage from all active accounts in 2019 for the Forest Preserves facilities and shows their total propane usage. A 20% reduction in propane use was then applied to these top users to generate a new estimate of how much energy would be used and saved if this reduction were achieved.

		Top 10 (used most gallons in 2019)												
Account #	**Account Name**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**TOTAL**
202354651	RM - Palos	1,500.90	1,603.20	-	580.80	450.30	-	-	-	-	1,001.70	-	1,101.20	6,238.10
202354651	RM - Palos	1,126.60	850.40	855.40	200.00	-	-	-	-	-	201.50	-	93.20	3,327.10
202354651	LM - Palos	525.30	502.40	-	540.80	-	-	-	-	-	250.30	-	161.90	1,980.70
202354651	LRSH Nature Center	150.30	450.30	501.60	306.50	-	-	-	-	-	325.20	-	-	1,733.90
202354651	Camp Bullfrog - TS-1	200.60	350.10	-	-	-	550.60	-	-	-	-	-	594.30	1,695.60
202354651	Camp - Dan Beard	245.20	399.90	-	350.00	-	-	-	-	-	498.00	-	-	1,493.10
202354651	Camp Bullfrog - Office	325.10	352.60	150.20	-	-	-	-	-	-	-	-	600.50	1,428.40
202354651	RM - Fisheries - house	772.80	425.50	-	-	-	-	-	-	-	215.70	-	-	1,414.00
202354651	RM - Fisheries - garage	693.10	383.10	119.40	-	93.50	-	-	-	-	26.20	-	-	1,315.30
202354651	Camp - Shabbona	287.10	221.80	-	130.70	-	-	-	-	-	-	-	256.50	896.10

	January	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**All 2019 Total**
Totals (gallons)	5,827.00	5,539.30	1,626.60	2,108.80	543.80	550.60	-	-	-	2,518.60	-	2,807.60	21,522.30

The top 10 accounts used 21,522.30 gallons which is 97.08**%** of all propane used by the FPDCC facilities in 2019.	21,522.30

If the top 10 **reduced their propane use by 20%** there would be a reduction of 4,304.46 gallons, which is **equivalent to reducing 19.42% from the total FPDCC** facilities gallons. This would bring usage within these 10 accounts down to 17,217.84 gallons.	17,217.84
	4,304.46

Appendix C: Solar Projection Models

Comparison of Solar Installation Generation to 2050 Goal Attainment

This table series compares the annual projected generation (kWh) of various size solar installations - utilizing 60 acres, 100 acres, 120 acres and 350 acres of land - to the Forest Preserves' (FPDCC) facilities, fleet and operations emissions kWh equivalent, and the kWh equivalent of 10% of a public sector partner's (PSP) electricity, in order to achieve both the Preserves' 2050 carbon neutrality goal and the PSP's renewable energy goal. While facilities are the focus of this Framework, FPDCC aims to offset its emissions in all sectors, thus the inclusion of fleet and operations emissions here.

Entity	2019 Emissions Sources	MTCO2e	FPDCC %	kWh
FPDCC Facilities	Electricity	3,670.51	39.4%	3,867,253
	Natural Gas	2,353.30	25.3%	2,479,348
	Propane	126.76	1.4%	133,554
FPDCC Fleet & Operations	Gasoline	1,651.33	17.7%	1,739,839
	Diesel	989.97	10.6%	1,043,037
	Propane	132.25	1.4%	139,341
	Waste & Recycling	391.61	4.2%	412,600
Total		**9,315.73**	**100%**	**9,814,972**
PSP	Partner 10% Electricity	22,446.84	NA	23,650,000

Solar Installation Generation Projections to Goal Coverage

60 acres			2050 Goal
	MWh Generation	13,106	
	kWh Generation	13,106,030	
FPDCC - Facilities	kWh Coverage - Excess	6,625,875	100%
FPDCC - Fleet & Ops.	kWh Coverage - Excess	3,151,717	100%
PSP	kWh Coverage - Shortage	(20,498,283)	13%

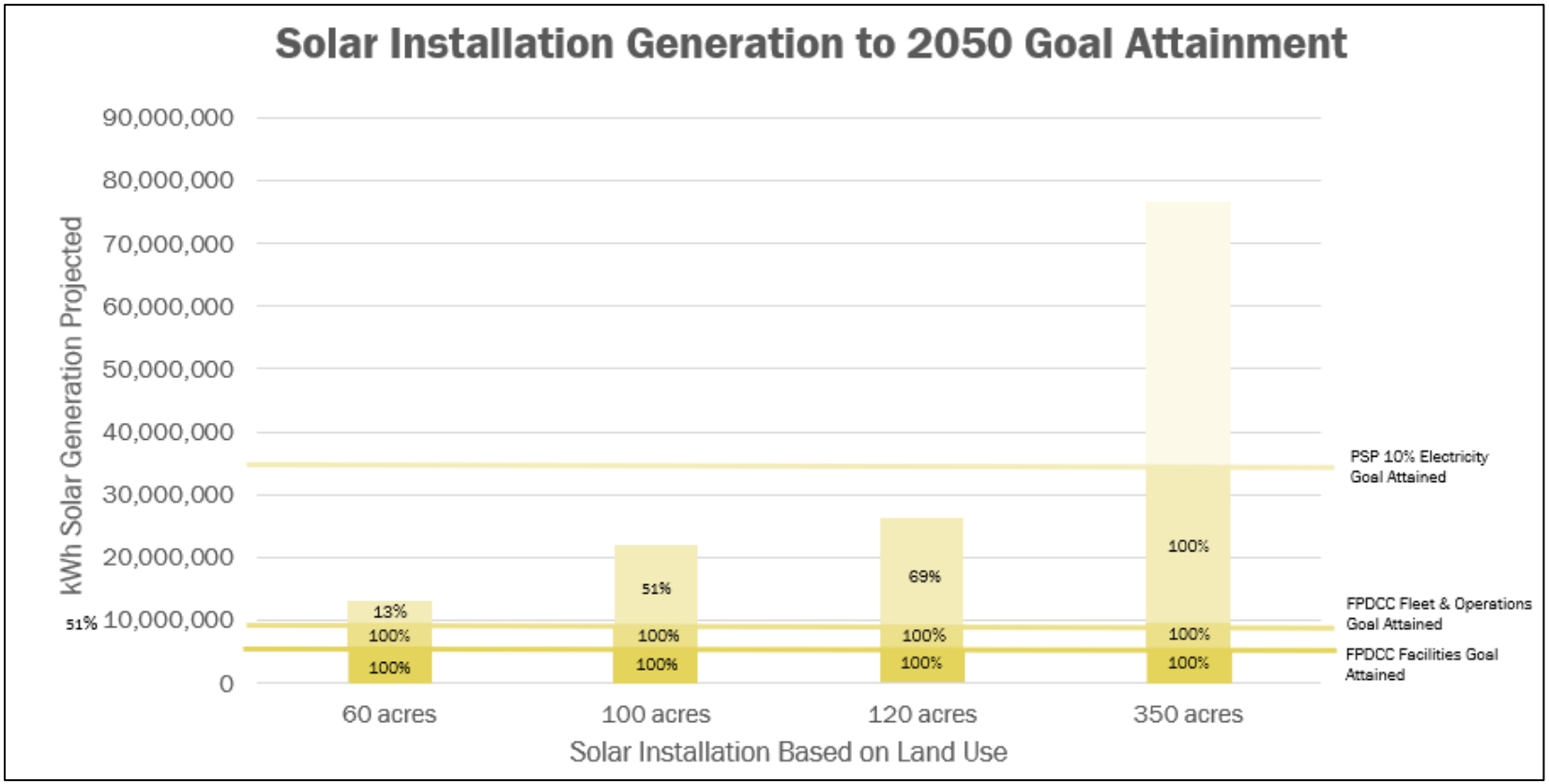
100 acres			2050 Goal
	MWh Generation	21,887	
	kWh Generation	21,887,070	
FPDCC - Facilities	kWh Coverage - Excess	15,406,916	100%
FPDCC - Fleet & Ops.	kWh Coverage - Excess	12,072,099	100%
PSP	kWh Coverage - Shortage	(11,577,901)	51%

120 acres			2050 Goal
	MWh Generation	26,213	
	kWh Generation	26,212,960	
FPDCC - Facilities	kWh Coverage - Excess	19,732,805	100%
FPDCC - Fleet & Ops.	kWh Coverage - Excess	16,397,988	100%
PSP	kWh Coverage - Shortage	(7,252,012)	69%

350 acres			2050 Goal
	MWh Generation	76,443	
	kWh Generation	76,443,135	
FPDCC - Facilities	kWh Coverage - Excess	69,962,980	100%
FPDCC - Fleet & Ops.	kWh Coverage - Excess	66,628,163	100%
PSP	kWh Coverage - Excess	42,978,163	100%

First the 2019 data from the many emission sources – FPDCC kWh of electricity; therms of natural gas and gallons of propane used in facilities; the tonnage of waste and recycling generated; the gallons of gasoline, diesel and propane used by fleet and operations, and 10% electricity of the PSP – was converted to MTCO2e using EPA's Pollution Prevention Greenhouse Gas Calculator and for waste, EPA's WARM model. The calculators were then utilized to identify kWh usage equivalencies of the MTCO2e to enable comparison to the solar installation generation projections. The solar installation generation projections are based on land-use and were calculated with US Department of Energy's National Renewable Energy Laboratory resources. The Preserves' kWh usage totals – first for facilities, then for fleet and operations - and then the PSP kWh usage total - were subtracted from the projected solar generation to yield "kWh Coverage" and a total shortage or excess for first FPDCC, then PSP. The "2050 Goal" column indicates attainment progress to FPDCC's 2050 carbon neutrality goal, and attainment of PSP's 10% goal.

Comparison of Solar Installation Generation to 2050 Goal Attainment



This figure details the projected kWh generated by 60, 100, 120 and 350 acre solar PV installations as compared to the kWh needed to meet the use of the Forest Preserve Facilities, Forest Preserve Fleet & Operations, and 10% of electricity use of the public sector partner (PSP) for 2050 goal attainment. The first yellow horizontal line represents the value at which the 2050 Goal is attained for Preserve Facilities in terms of kWh equivalencies, the second line indicates the value at which Preserve Fleet & Operations emissions needs are met in terms of kWh equivalencies, and the third line indicates the value at which the both Preserve needs and 10% of the PSP's needs are met. The pale yellow indicates excess kWh.

Comparison of Solar Installation Generation to 2050 Goal Attainment with 20% Energy Efficiency Reduction

This table series builds on those at the beginning of Appendix C, comparing the annual projected generation (kWh) of various size solar installations to the Forest Preserves' (FPDCC) facilities, fleet and operations kWh equivalent, as well as the kWh equivalent of 10% of a public sector partner's (PSP) electricity, in order to achieve both the Preserves' 2050 carbon neutrality goal and the PSP's renewable energy goal, while also embodying the first Energy Roadmap Strategy: REDUCE through energy efficiency. A 20% reduction in usage through energy efficiency measures is considered for the top 10 user accounts with regard to facilities electricity, natural gas, and propane usage (in kWh, therms, and gallons, respectively), as well as a 20% reduction by fleet and operations in terms of tons of waste generated and gallons of gasoline, diesel and propane used. While facilities are the focus of this Framework, FPDCC aims to offset its emissions in all sectors, thus the inclusion of fleet and operations emissions here.

Entity	2019 Emissions Sources	MTCO2e	FPDCC %	kWh
FPDCC Facilities	Electricity	3,670.51	39.4%	3,867,253
	Natural Gas	2,353.30	25.3%	2,479,348
	Propane	126.76	1.4%	133,554
FPDCC Fleet & Operations	Gasoline	1,651.33	17.7%	1,739,839
	Diesel	989.97	10.6%	1,043,037
	Propane	132.25	1.4%	139,341
	Waste & Recycling	391.61	4.2%	412,600
Total		**9,315.73**	**100.0%**	**9,814,972**
Energy Efficiency Reductions				
FPDCC Facilities	20% of top 10 Electric accts	(378.19)	-4.1%	(398,461)
	20% of top 10 Nat. Gas accts	(258.69)	-2.8%	(272,557)
	20% of top 10 Propane accts	(24.61)	-0.3%	(25,931)
FPDCC Fleet & Operations	20% of Gasoline use	(330.27)	-3.5%	(347,967)
	20% of Diesel use	(198.00)	-2.1%	(208,608)
	20% of Propane use	(26.45)	-0.3%	(27,686)
	20% of Waste generation	(101.23)	-1.1%	(106,656)
Total		**(1,317.43)**	**-14.1%**	**(1,387,866)**
PSP	Partner 10% Electricity	22,446.84	NA	23,650,000

Solar Installation Generation Projections to Goal Coverage

60 Acres	MWh Generation	13,106	**2050 Goal**
	kWh Generation	13,106,030	
FPDCC - Facilities	kWh Coverage - Excess	7,322,825	100%
FPDCC - Fleet & Ops.	kWh Coverage - Excess	4,678,925	100%
PSP	kWh Coverage - Shortage	(18,971,075)	20%

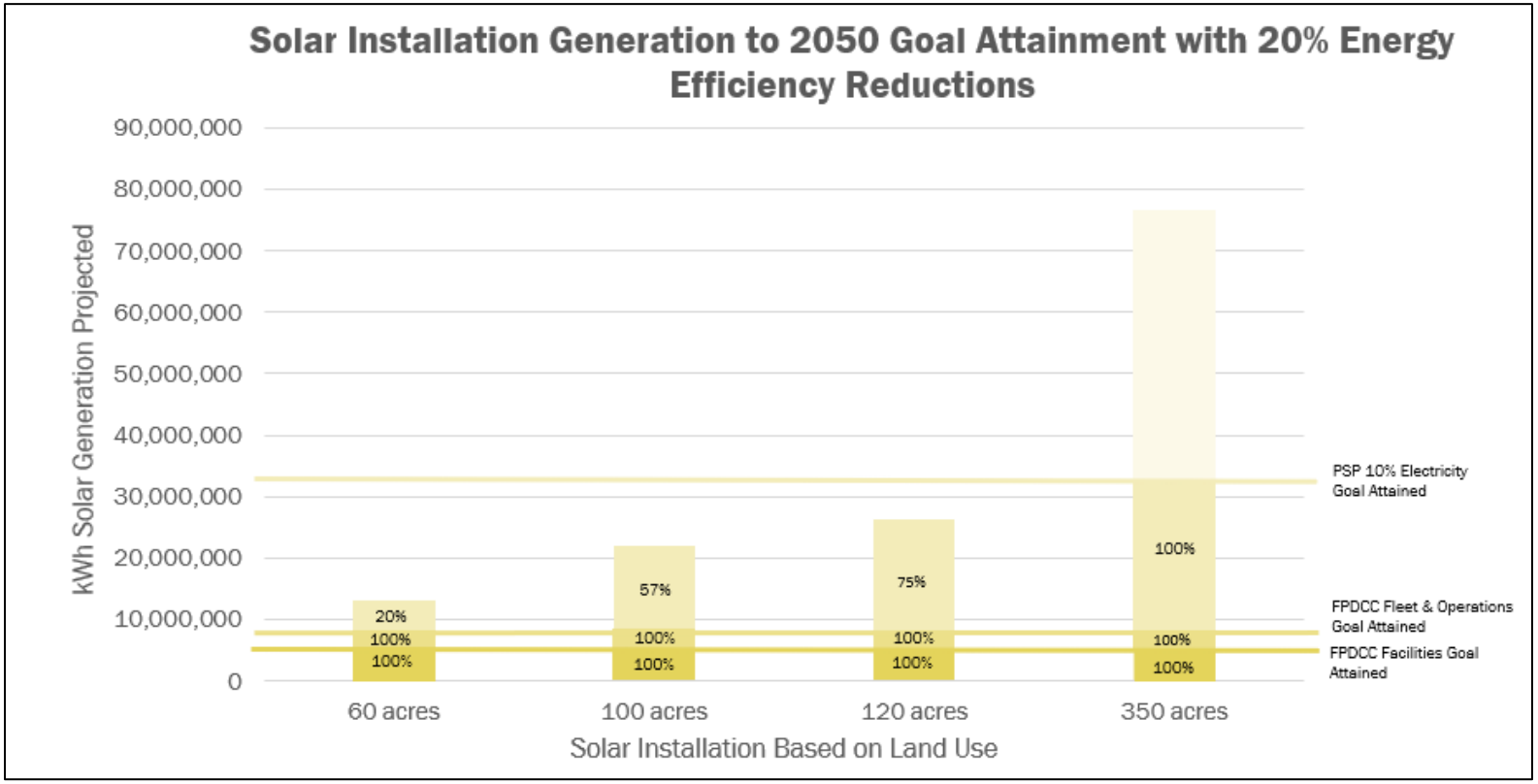
100 Acres	MWh Generation	21,887	**2050 Goal**
	kWh Generation	21,887,070	
FPDCC - Facilities	kWh Coverage - Excess	16,103,865	100%
FPDCC - Fleet & Ops.	kWh Coverage - Excess	13,459,965	100%
PSP	kWh Coverage - Shortage	(10,190,035)	57%

120 Acres	MWh Generation	26,213	**2050 Goal**
	kWh Generation	26,212,960	
FPDCC - Facilities	kWh Coverage - Excess	20,429,755	100%
FPDCC - Fleet & Ops.	kWh Coverage - Excess	17,785,855	100%
PSP	kWh Coverage - Shortage	(5,864,145)	75%

350 Acres	MWh Generation	76,443	**2050 Goal**
	kWh Generation	76,443,135	
FPDCC - Facilities	kWh Coverage - Excess	70,659,929	100%
FPDCC - Fleet & Ops.	kWh Coverage - Excess	68,016,029	100%
PSP	kWh Coverage - Excess	44,366,029	100%

First the 2019 data from the many emission sources of FPDCC, the efficiency reductions of each emission source, and 10% electricity of the PSP was converted to MTCO2e using EPA's Pollution Prevention Greenhouse Gas Calculator (for electricity and fuel), and EPA's WARM model (for waste). The calculators were then utilized to identify kWh usage equivalencies of the MTCO2e to enable comparison to the solar installation generation projections. The solar installation MWh/kWh generation projections are based on land use, and were calculated with US Department of Energy's National Renewable Energy Laboratory resources. The Preserves' kWh usage totals – first for facilities, then for fleet and operations - and then the PSP kWh usage total - were subtracted from the projected solar generation to yield "kWh Coverage" and a total shortage or excess for first FPDCC, then PSP. The "2050 Goal" column indicates attainment progress to FPDCC's 2050 carbon neutrality goal, and attainment of PSP's 10% goal.

Comparison of Solar Installation Generation to 2050 Goal Attainment with 20% Energy Efficiency Reductions



This figure details the projected kWh generated by 60, 100, 120 and 350 acre solar PV installations as compared to the kWh needed to meet the use of the Forest Preserve Facilities with energy efficiency reductions, Forest Preserve Fleet & Operations with energy efficiency and waste generation reductions, and 10% of electricity use of the public sector partner (PSP) for 2050 goal attainment. The first yellow horizontal line represents the value at which Preserve Facilities needs are met in terms of kWh equivalencies, the second line indicates the value at which Preserve Fleet & Operations emissions needs are met in terms of kWh equivalencies, and the third line indicates the value at which the both the Preserve and 10% of the PSP's needs are met. The pale yellow indicates excess kWh.

Appendix D: 100 Percent Renewable Survey Responses

All responses are presented as received through the survey. Results are organized from highest population to lowest for each response.

Jurisdiction	State	Pop.	Median Household Income	Goal Parameters	Contact	Contact Title
City of Fayetteville	AR	86,000	$37,350	100% for City Gov by **2030** and 100% Community Wide by **2050.**	Chris McNamara	Sustainability Project Manager
City of Largo	FL	85,000	$41,008	City operations by **2035** and the whole community by **2050** to include buildings, transportation, etc.	Laura Thomas	Sustainability Program Administrator
Summit County	UT	40,000	$94,952	Net 100% renewable electrical energy for all government operations by **2030**, Net 100% renewable electrical energy for all electric utility customers in the communities (residential and commercial) who passed resolutions by Dec 2019 containing a net 100% renewable electrical energy goal by **2030**.	Lisa Yoder	Sustainability Program Manager
Cottonwood Heights	UT	33,996	$86,207	Our goal is to reach net-100% renewable energy, community-wide, by 2030.	Samantha DeSeelhorst	Assistant Planner and Sustainability Analyst
City of Lafayette	CO	30,000	$71,083	**2030**, community-wide.	Tony Raeker	Sustainability Coordinator
City of Keene	NH	23,406	$52,327	**2030** for electricity and **2050** for transportation.	Mari Brunner	Planner
City of Milwaukie	OR	21,000	$55,827	Net-zero emissions from electricity by **2030**, net-zero emissions from building fuels by **2035**, net-zero emissions community-wide by **2045.**	Natalie Rogers	Climate Action and Sustainability Coordinator

East Pikeland Township	PA	9,000	$72,850	2035 for electricity, 2050 for heat and transportation.	Michelle Rubin	Community Resources Coordinator
Town of Breckenridge	CO	5,000	$54,328	Our 2025 commitment is only electricity for municipal operations. Community-wide, our goal is to reach 100% renewable energy sources by 2035.	Emily Niederbremer	Sustainability Intern
Nederland	CO	1,500	$62,125	100% of buildings within Town limits, including municipal, commercial, and residential by 2025.	Melody Baumhover	Chair, Nederland Sustainability Advisory Board

Are you on track to meet your goal? Please elaborate.

Jurisdiction	State	Response
City of Fayetteville	AR	For City Gov yes. For community, no.
City of Largo	FL	No, we are still working on measuring a baseline.
Summit County	UT	Yes. In partnership with the predominate electric utility, we passed the HB411, Community Renewable Energy Act, a state law that requires the electric utility to provide net 100% renewable electrical energy to communities in Utah that have adopted resolutions with the goal to achieve net 100% renewable electrical energy by 2030.
Cottonwood Heights	UT	Yes. Our goal is linked to HB 411, "The Community Renewable Energy Program" and is a collaboration with 23 other Utah communities. We are on track with this program.
City of Lafayette	CO	At municipal facilities (58%), yes, as a community (unknown), no.
City of Keene	NH	Not sure - the City adopted these goals in January 2019, and the City is currently working on creating a plan to reach these goals. The City itself (municipal operations) already sources 100% electricity from renewables; however, our goal applies to the entire community including residents, businesses, non-profits, etc.
City of Milwaukie	OR	Based on a recent carbon emissions accounting analysis performed in December, 2019, we have a 40% gap to close to reach our 2030 goal. We are currently working with our electric utility to increase participation in renewable electricity products, pursue a community-wide renewable product option, and perform outreach and education around energy efficiency and electrification. We believe we can achieve our 2030 goal with community participation. We have more work to do to reach our 2035 and 2045 goals.

East Pikeland Township	PA	We have only started this process and are not sure of a timeline at this time.
Town of Breckenridge	CO	Yes, just bought enough energy from community solar gardens to fully power all electricity to our municipal buildings. However, we cannot claim to have achieved this goal yet because a large water treatment plant is being built this summer and will use a lot of energy. This energy has yet to be powered by renewables.
Nederland	CO	We have made steps towards achieving our goal, but still have a ways to go. The Town has purchased energy for all municipal facilities from solar power, and we have about 4% of residents signed up for wind or solar energy through Xcel, our energy provider. We have an MOU to work with Xcel towards our renewable goals, and are working through their Partners In Energy Program to stimulate efficiency discussions and action. We worked with a Masters of the Environment group from CU to develop metrics for analyzing future steps and an energy tracking tool. Beyond this, we have hired a part-time Sustainability Coordinator for 2020 to help us achieve our goals.

What is the scope of the 100% renewable commitment? (e.g. Does this mean that your city would like all buildings to run on 100% renewables by your goal year? All city operations? All transportation? What exactly is expected to run on 100% renewables by the goal year?)

Jurisdiction	State	Response
City of Fayetteville	AR	100% of traditional grid-supplied electricity to be supplied by 100% renewable energy. This does not include heating from natural gas.
City of Largo	FL	City operations by 2035 and the whole community by 2050 to include buildings, transportation, etc.
Summit County	UT	We have 2 goals: 1.) County operations - Net 100% renewable electrical energy for all government operations by 2030. A 15-year purchasing agreement is in place with the utility to procure the annualized total amount of electricity used in a year from a newly constructed solar farm beginning in 2023. We are 7 years ahead of our goal. 2.) Countywide - Net 100% renewable electrical energy for all electric utility customers in the communities (residential and commercial) who passed resolutions by Dec 2019 containing a net 100% renewable electrical energy goal by 2030. 20 cities and 3 counties have passed resolutions to participate. However, after receiving projected renewable electrical energy rates, communities may opt out of program. For the communities who remain IN the Community Renewable Energy program, individual customers may OPT OUT after an opportunity to compare standard renewable electrical energy rate with new renewable electrical energy rate.
Cottonwood Heights	UT	Our goal is to reach net-100% renewable energy, community-wide, by 2030. There will be opt-out options for utility customers within the community who wish to not participate.

City of Lafayette	CO	100% renewable electricity by 2030, community-wide.
City of Keene	NH	2030 Electricity Goal: All electricity used within the City of Keene will come from renewable sources, including residents, businesses, nonprofits, etc. 2050 Thermal Goal: All energy used for heating and cooling within the City of Keene will come from renewable sources, including residents, businesses, nonprofits, etc. 2050 Transportation Goal: All energy used to power light-duty vehicles registered in Keene will come from renewable sources by 2050.
City of Milwaukie	OR	We are interested in 100% carbon-free electricity by 2030 for all community customers, including residential, commercial and industrial customers. The city is already on 100% net-zero carbon electricity through PGE's clean wind product, and has signed a 15 solar contract for city operations once developed. The 2030 goal to be net-zero emissions includes all carbon-free energy options, such as solar and wind, but also large hydro which is not a renewable energy option. It does not include current renewable energy options that produce emissions at time of electricity generation, such as biomass and biofuels.
East Pikeland Township	PA	Our goals is to transition to 100% clean and renewable energy, and to complete this transition for electricity by 2035 and for heat and transportation by 2050.
Town of Breckenridge	CO	Only electricity will be 100% renewable. This does not include natural gas; our buildings will still have natural gas for heating. Our 2025 commitment is only for municipal operations. Community-wide, our goal is to reach 100% renewable energy sources by 2035.
Nederland	CO	100% of buildings within Town limits, including municipal, commercial, and residential.

What types of renewable energy are you implementing to achieve your goal? Please indicate the renewable type and if it is being implemented on-site (such as rooftop solar, geothermal etc.) or off-site (such as a solar farm, wind farm, etc).

Jurisdiction	State	Response
City of Fayetteville	AR	Rooftop and ground mounted solar within city limits and windfarm utility supplied from Oklahoma
City of Largo	FL	rooftop solar, geothermal, wind, solar farm, RECs
Summit County	UT	A solar farm is being constructed off site to provide net 100% of Summit County's annualized electrical energy needs. The type(s) of renewable energy to meet the community-wide goal will be determined through a request for proposal process to obtain whatever type of renewable energy is available at the best price, preferably sited in Utah.
Cottonwood Heights	UT	Resource procurement is still being determined.
City of Lafayette	CO	Mostly solar, but still figuring it out. I'm the sole sustainability staff person, and my position was only created a year ago, so I'm working on it.
City of Keene	NH	Not sure - implementation has not yet started. Businesses have already been installing solar and, in some cases, biomass boilers. The City itself has installed several RE systems including a hydroelectric turbine at the water treatment facility, solar PV at the Public Works building, geothermal system at the Public Works building, a 100% post-consumer biodiesel generator at the Transfer Station, and the City is currently working on getting a RE system of some type at

		the Wastewater Treatment Plant. However, this all happened or was in the works prior to the goals being adopted.
City of Milwaukie	OR	The city has rooftop solar on the Milwaukie Ledding Library building. The city is currently purchasing wind REC-based products for operations for 100% operational use, but will be switching to a bundled REC product through the Green Future Impact green tariff product from PGE. This is an off-site solar generation facility. The city encourages residents and businesses to participate in voluntary renewable products through PGE (unbundled/bundled REC products that include a range of Green-e certified renewables) as well as community solar (off-site subscription based solar arrays), and on-site solar. We currently have approximately 1.7 MW of rooftop solar in the city of Milwaukie.
East Pikeland Township	PA	We are focusing on renewable sources such as wind, solar, small hydro, tidal, fuel cells, geothermal, and other sources yet to be developed. We are not sure yet what will be on-site or off-site.
Town of Breckenridge	CO	We have rooftop solar, two local solar gardens, out-sourced community solar elsewhere in Colorado, and the solar/wind commitments by Xcel Energy.
Nederland	CO	Mostly off-site solar. Financing and space are the major hindrances to on-site solar or wind. Our Town shop has a small geothermal pump.

Does your renewable energy policy mention the creation of a solar or wind farm to provide a certain percentage of your community's electricity needs based on a consumption baseline from a given year?

Jurisdiction	State	Response
City of Fayetteville	AR	Solar farms are mentioned by do not require to meet a certain percentage of production
City of Largo	FL	We do not have a policy- we have a resolution. There is no space in our city large enough for a solar or wind farm.
Summit County	UT	Yes, both county and community-wide policy use current and projected electrical needs.
Cottonwood Heights	UT	Resource procurement is still being determined.
City of Lafayette	CO	Our GHG targets have a baseline year, but not our renewable energy goal.
City of Keene	NH	No, the City adopted a Resolution which makes a general commitment to the above-stated goals but does not list specifics. More specific goals, objectives, and strategies will be included in the plan to reach these goals, which has not yet been developed.
City of Milwaukie	OR	There is no requirement for a percentage of the community's electricity use to be sourced from new generation infrastructure. The Climate Action Plan does call for the city to develop or encourage development of a community solar project, however, that doesn't need to be in the city limits. The CAP also calls for the development of microgrids in the city, which could also implement on-site renewable generation infrastructure.
East Pikeland Township	PA	It does not mention the creation of a solar or wind farm.

Town of Breckenridge	CO	No. However, Town of Breckenridge (ToB) did build two 500kW solar gardens in 2013 which ToB uses 40% of energy produced.
Nederland	CO	This idea has been discussed, and is possibly a part of the plan of funding and space needs can be met. Currently we are looking into Xcel's solar subscription programs.

What legislation is in place to assist in this goal becoming a reality? Please provide a link to legislation.

Jurisdiction	State	Response
City of Fayetteville	AR	ftp://www.arkleg.state.ar.us/acts/2001/htm/ACT1781.pdf and http://www.arkleg.state.ar.us/assembly/2019/2019R/Acts/ACT464.pdf
City of Largo	FL	Our resolution: https://www.largo.com/document_center/Commission%20Agendas%20&%20Minutes/2018/080718/item_18%20-%20res.%202219.pdf and our Sustainability Plan: https://www.largo.com/document_center/City%20Manager's%20Office/Largo%20Environmental%20Action%20Plan.pdf
Summit County	UT	HB-411 Community Renewable Energy Act passed in March 2019. https://le.utah.gov/~2019/bills/static/HB0411.html
Cottonwood Heights	UT	HB 411 - https://le.utah.gov/~2019/bills/static/HB0411.html
City of Lafayette	CO	Can't link to it, but it's Resolution 2017-63
City of Keene	NH	Not sure what this means… NH recently enabled Community Choice Aggregation as an opt-out program (previously only allowed as an "opt-in" program) and this will be a key strategy to reach the electricity goal for residents in Keene.
City of Milwaukie	OR	The resolution to adopt a Climate Action Plan - https://www.milwaukieoregon.gov/resolution-84-2018-adopting-climate-action-plan-cap The resolution to declare a climate emergency, and accelerate the CAP goals - https://www.milwaukieoregon.gov/sites/default/files/fileattachments/sustainability/page/111121/r7-2020.pdf
East Pikeland Township	PA	None at this time, PA is working to pass a community solar bill. https://www.spglobal.com/marketintelligence/en/news-insights/trending/lQBZxLRmg4XpLXK72rwb8A2
Town of Breckenridge	CO	Three resolutions: Resolution No. 21 of Series 2017: https://www.townofbreckenridge.com/home/showdocument?id=13289 Resolution No. 28 of Series 2017: http://www.townofbreckenridge.com/home/showdocument?id=12868 Resolution No. 9 of Series 2019: https://www.townofbreckenridge.com/home/showdocument?id=16918 These resolutions formally committed ToB to renewable electricity for municipal operations by 2025, to renewable electricity community-wide by 2035, and to the Summit Community Climate Action Plan, respectively.
Nederland	CO	Municipal Resolutions - https://nederlandco.org/government/town-boards/sustainability-advisory-board/

Who are the major stakeholders who will make this goal a reality?

Jurisdiction	State	Response
City of Fayetteville	AR	Cities, Utilities (SWEPCO and Ozarks Electric) and Walmart
City of Largo	FL	Sustainability Program Admin, Facilities Manager, Public Works Director, Community Development Director
Summit County	UT	Local governments of Summit County, Salt Lake County, Salt Lake City, and Park City
Cottonwood Heights	UT	Rocky Mountain Power, Public Service Commission, 23 Utah Communities
City of Lafayette	CO	Me, the facilities team, Public Works, Xcel energy, solar providers, and probably some form of assistance from Bounder County.
City of Keene	NH	The utility provider (Eversource); local businesses / champions; other large institutions such as Keene State College, the hospital, & Keene Housing; local advocates; local elected officials.
City of Milwaukie	OR	Elected Officials, City Staff, Community Residents, Community businesses and industry, Utilities, Community Based Organizations
East Pikeland Township	PA	Working with other municipalities, industries, and commercial businesses to do a power purchase agreement together.
Town of Breckenridge	CO	Town of Breckenridge, Pivot Energy, Xcel Energy, Clean Energy Collective, Active Energies Solar, Innovative Energy, and High Country Conservation Center.
Nederland	CO	Town Government, Local Businesses, Community Members, Xcel Energy

Are there individuals employed to support this effort? Please elaborate if so.

Jurisdiction	State	Response
City of Fayetteville	AR	Yes. Employees of the Arkansas Advanced Energy Association focus on this work
City of Largo	FL	Not specifically, it is just one of my duties
Summit County	UT	Lisa Yoder (self) - Summit County Christopher Thomas - Salt Lake City Michael Shea - Salt Lake County Luke Cartin - Park City
Cottonwood Heights	UT	Yes. Most cities have designated sustainability representatives.
City of Lafayette	CO	Yes, me. That's it.

City of Keene	NH	Yes and No. The City has a volunteer committee (Energy and Climate Committee) that is helping with the development of an energy plan to meet the City's goals. This committee makes recommendations to City Council. I provide staff support to this committee and am the lead staff person working on the energy plan. The City did contract with a consultant on a short-term basis to help us get electricity data from our utility, develop an electricity baseline for Keene, and identify strategies/objectives we can pursue to reach 100% renewable energy by 2030. However, we do not have anyone employed specifically to help with this effort. My work on this project is in addition to all my regular duties.
City of Milwaukie	OR	Myself - Climate Action and Sustainability Coordinator. I started after the adoption of the CAP in November, 2018. Peter Passarelli, our Public Works Director, also uses his time to facilitate CAP work. My position is within the Public Works Department.
East Pikeland Township	PA	The Environmental Advisory Council, a township volunteer board, are working to guide the township toward this goal.
Town of Breckenridge	CO	Yes, one full time Sustainability Coordinator and two part-time Sustainability Interns.
Nederland	CO	We have hired a part-time coordinator for all of our sustainability efforts.

How is this goal communicated and encouraged across the community?

Jurisdiction	State	Response
City of Fayetteville	AR	Goal is communicated on City media and community outreach and in City long range plans
City of Largo	FL	Marketing campaigns when it first launched, now through event communications and LEAP updates
Summit County	UT	
Cottonwood Heights	UT	We've held public hearings and open houses relating to this goal.
City of Lafayette	CO	Website, social media, utility bill inserts, newsletters, etc.
City of Keene	NH	There has been some media coverage, but not a lot. The Energy and Climate Committee has held one community workshop and a series of about 15 small group discussions (called "Community Energy Conversations") with residents to discuss the goals. I have held two focus groups so far with local landlords and local institutions (large, not-for-profit energy users), and a third focus group is scheduled for later this month. The goal is to have a draft plan ready by the end of the summer of 2020 to release for public comment and introduce to City Council for adoption.
City of Milwaukie	OR	Through social media, community newsletters, frequent updates to council, at events, through partner campaigns, presentations, etc.
East Pikeland Township	PA	We have shared information on our resolution, no other info has been communicated at this time.

Town of Breckenridge	CO	This is marketed in the Summit Community Climate Action Plan which was signed by Summit County, all Towns in Summit County, Colorado Mountain College, Summit School District, and many resorts in the county. Additionally, it is communicated directly to residents through a program called Solarize Summit. This is run by High Country Conservation Center (HC3) which is marketed by Summit County, HC3, and ToB.
Nederland	CO	Through social media, Town Government, and at special events with our nonprofit partners.

Are there any roadblocks that you either already have, or will face in achieving this goal?

Jurisdiction	State	Response
City of Fayetteville	AR	That state legislature and utilities present constant and significant roadblocks to renewable integration
City of Largo	FL	We have no baseline data, I am the only staff dedicated to this
Summit County	UT	Expect to encounter utility's view of stranded asset costs and other administrative fees that could make the renewable energy rate and associated regulatory filing fees disagreeable to communities. Expect regulatory agencies to tack on costs that prevent cost-shifting to non-participating customers
Cottonwood Heights	UT	Challenges may include implementation costs
City of Lafayette	CO	Yes, capacity. There's only so much I can do (I also handle all the green/healthy building programs, waste reduction and recycling, local food, etc.)
City of Keene	NH	For the electricity goal the City cannot control what others choose to do, so we won't to get close to 100% renewable sources for electricity unless the default electricity supply from the utility provider becomes 100% renewable by 2030. As for the thermal goal, we do not have enough data to know what energy is currently being used for heating and cooling, so it is a huge challenge to create a baseline in order to measure/track progress. We have no good way of knowing what type of heating system individual residents or businesses have, or what fuel they use (let alone how much). For transportation, a large barrier is the fact that we live in a rural area and people completely depend on automobiles to get around. Public transportation is not going to happen anytime soon - it isn't economically feasible and the little that we have is struggling. We are working on encouraging people to walk and bike more through our complete streets efforts and rail trail system, but many people commute in from surrounding towns/states and it isn't realistic for people to walk or bike that far.
City of Milwaukie	OR	Voluntary resident/business participation, state legislation that preempts local requirements (e.g. state building code), staff capacity and city resource limitations, utility participation

East Pikeland Township	PA	We are currently working to create a coalition of local governments to work together and add to our purchase power, but implementing across all municipalities may be difficult depending on leadership. Also, getting all residents to 100% will be difficult.
Town of Breckenridge	CO	Yes, before HB19-1003 was passed in 2019, Colorado solar gardens were limited to be built in the same or adjacent county as the subscriber, which is difficult for Breckenridge given our lack of flat, usable land in the mountains. Once HB19-1003 was passed, we were able to subscribe to community solar gardens that were located elsewhere. Another roadblock we are about to face is the construction of a new Water Treatment Plant because it will use a lot of energy and it is not planned to have rooftop solar panels.
Nederland	CO	Money and Land

How have you or do you plan to overcome these roadblocks?

Jurisdiction	State	Response
City of Fayetteville	AR	
City of Largo	FL	Slowing working with the region to help leverage resources
Summit County	UT	Yes, the 23 communities are forming a cooperative statement to negotiate with one voice, using their own legal representatives to protect them, with employment of an expert energy attorney to represent the Utah 100 Communities as a whole.
Cottonwood Heights	UT	Costs will be shared among 23 communities, and we are in discussions about how to split them proportionately
City of Lafayette	CO	I'm getting an intern. That will help a bit. Other than that, I just continuously look for grants or other forms of assistance that will help us inch toward the goals.
City of Keene	NH	For transportation, we are focusing on accelerating the transition to EVs and encouraging future land use/growth patterns that promote infill development and walkability in our downtown area. In addition, we are continuing our "Complete Streets" policy and investing in a multi-use trail network. For the thermal sector, we are looking at possible ordinances/policies we could adopt that could help with data collection, such as benchmarking policy that would be tied to some sort of incentive, or a home energy labeling program for homes when they get listed on the market. For electricity, the City is in the early stages of considering a Community Choice Aggregation program, which may help us provide cleaner electricity at a cost-competitive rate to residents and business who are not already on competitive energy supply.
City of Milwaukie	OR	Increased outreach and engagement, strategic planning for CAP actions with the greatest impact for staff to focus on, coordination with other jurisdictions to increase pressure on state and utility partners
East Pikeland Township	PA	Trying to educate people as much as possible and find solutions that will make it a no-brainer to switch to renewable energy.

Town of Breckenridge	CO	Luck for us, the community solar garden limitations solved itself. Regarding the water treatment plant, we will most likely need to subscribe to a lot more community solar gardens.
Nederland	CO	Community-building, working with organizations like SEI and others to acquire funding. We are also working with Colorado Communities for Climate Action and the Colorado Municipal League to support State legislations that support renewable energy.

If you have already encountered roadblocks, how have you communicated with stakeholders and/ or the community about the challenges faced?

Jurisdiction	State	Response
City of Fayetteville	AR	
City of Largo	FL	
Summit County	UT	Yes, all members have convened and have been prepared about the need to negotiate as a single entity, informed by individual legal staff.
Cottonwood Heights	UT	There has been a lot of questions about this program from our residents and business owners, and we've addressed these questions with transparency about what we do and do not know, and will continue to do so. We've also reiterated that each electricity customer will have the opportunity to opt-out, if they so desire.
City of Lafayette	CO	Only been here a year, so haven't had to yet.
City of Keene	NH	Not sure - we are still in the planning stages, so we haven't done a lot of messaging around roadblocks (still trying to build support for the goals
City of Milwaukie	OR	Through presentations, frequent meetings and conversations, through city communication pathways
East Pikeland Township	PA	None so far.
Town of Breckenridge	CO	Since we are so far ahead of schedule to meet our goal of 100% renewable electricity by 2025 we have not needed to communicate these roadblocks to our community or stakeholders.
Nederland	CO	

Will your community focus on specific technologies or strategies to achieve your renewable energy goal, and if so, which ones? Have other technologies/strategies been considered, and if so, are there reasons why those are not being pursued?

Jurisdiction	State	Response
City of Fayetteville	AR	By building a strong coalition with influential players in the state that have interest in renewable and by bringing dockets before the Public Service Commission who makes many of the rulings that affect access to renewables and the market dynamics involved
City of Largo	FL	We don't know yet
Summit County	UT	answered above
Cottonwood Heights	UT	An energy strategy firm will advise us on these issues
City of Lafayette	CO	I'm overseeing an energy services contract to upgrade a bunch of City facilities. Plug the holes in the boat before to start use the bucket. We'll make the renewables go farther that way.
City of Keene	NH	See answers to "How have you or do you plan to overcome these roadblocks?" above. In general, our approach for each sector is to reduce energy use first, then promote local renewable energy generation, and finally encourage fuel switching to renewable sources to make up the remaining difference.
City of Milwaukie	OR	See above answers - in particular, Milwaukie is interested in Microgrid technologies and community-scale clean energy purchase options.
East Pikeland Township	PA	Yet to be determined.
Town of Breckenridge	CO	We have focused mostly on solar; particularly community solar gardens. We have considered hydroelectricity, however, our flow was so low that it would not produce nearly enough energy for the Town, let alone the community. Wind was considered, but solar is more convenient and less expensive.
Nederland	CO	

Are there any benefits not directly related to greenhouse gas emissions which your community has experienced as the result of your pursuit of 100% renewable energy (e.g. positive media coverage, increased tourism, impacts on jobs/employment, impacts on human health or well-being, etc.)?

Jurisdiction	State	Response
City of Fayetteville	AR	Positive media coverage, branding for the city, money saved
City of Largo	FL	Positive media coverage

Summit County	UT	Yes, positive media coverage for this ground-breaking utility/local government partnership. Results expected to include increased renewable energy jobs and property tax revenue to communities where renewable resources will be sited; long term improvement to air quality with transition to clean energy grid; renewable electrical energy to charge fast-growing transportation sector transition to electric vehicles that will provide an immediate reduction in tail pipe emissions.
Cottonwood Heights	UT	Efforts toward renewable energy have resulted in positive media coverage, stronger relationships between communities, and momentum for other sustainability initiatives
City of Lafayette	CO	Yes, some of our lower income residents have gotten solar through special programs, which increases the energy security. We're also considering carport solar for our police station, which will reduce the insurance costs from hail damage and keep the vehicles cooler in summer. There are a bunch more, too many to list here.
City of Keene	NH	Not sure - we aren't tracking this, not sure how we would.
City of Milwaukie	OR	The city is also pursuing a canopy goal of 40% tree canopy coverage by 2040 in our CAP, which brings a variety of additional benefits from health to urban heat island mitigation and property value increases. The city can also increase awareness of clean energy technology incentives to residents and businesses, which brings additional cost savings to the city.
East Pikeland Township	PA	None yet.
Town of Breckenridge	CO	Jobs have been created as a result of this, like solar installers and sustainability positions within businesses and governments. We have had a lot of positive media coverage from the newspaper as well as social media. No data has been collected regarding our regional health/well-being.
Nederland	CO	

Has your community also considered energy efficiency and conservation strategies as part of its plan to reach your 100% renewable energy goals?

Jurisdiction	State	Response
City of Fayetteville	AR	Yes
City of Largo	FL	Yes we will be considering that
Summit County	UT	Yes, energy efficiency is our first strategy toward the Summit County's 2 GHG emissions reduction goals: County - Reduce GHG emissions 80% below 2016 level by 2040. Countywide - Reduce GHG emissions 80% below 2016 level by 2050. Energy efficiency improvements are being made within county owned facilities as resources allow. Energy efficiency programs are being administered to residents and businesses throughout the county.
Cottonwood Heights	UT	Yes, absolutely.
City of Lafayette	CO	Yes, see above.
City of Keene	NH	Yes
City of Milwaukie	OR	Yes

East Pikeland Township	PA	Yes
Town of Breckenridge	CO	Yes, HC3 does energy audits which is rebated by ToB and other agencies. The Town is looking to adopt and enforce the most updated version of the International Energy Conservation Code and Zero Energy Ready Homes from the Department of Energy. These initiatives will increase energy efficiency throughout the community. Additionally, ToB requires mandatory commercial building retro-commissioning and benchmarking. Breckenridge also encourages residents to retrofit lights to use LED lights.
Nederland	CO	Yes

Is there any other information or links you would like to provide?

Jurisdiction	State	Response
City of Fayetteville	AR	
City of Largo	FL	
Summit County	UT	Summit County has built a robust electric vehicle charging network throughout the county to provide electric vehicle charging for county fleet vehicles, residents and interstate travelers. Charging stations are available at no cost to users. When the transition to net 100% renewable electrical energy is complete, the county's electric transit bus fleet (co-operated by Park City) will be entirely free of emissions.
Cottonwood Heights	UT	Our program also has a low-income component to engage residents who may be struggling to pay their electricity bills currently. It's important to provide equitable options for participation on all levels.
City of Lafayette	CO	
City of Keene	NH	We are still in the planning phase, so we haven't begun implementation yet or seen any results so far. The 2030 goal is extremely ambitious - we previously had a goal to reduce emissions within the community sector (residents, businesses, non-profits, waste stream, etc.) by 10% over a 20-year timeframe; however, the community only reduced emissions by about 3% over 20 years. Now, we have a much more ambitious goal and half the time to achieve it. In order to reach this goal - or even come close - there needs to be some major funding to support the transition. We have not seen that at the federal or state level in NH, and we already have one of the highest tax rates in the state. The City can only do so much on its own.
City of Milwaukie	OR	Milwaukie CAP - https://www.milwaukieoregon.gov/sites/default/files/fileattachments/sustainability/page/85191/2018_1003_climateactionplan.pdf
East Pikeland Township	PA	https://www.eastpikeland.org/vertical/Sites/%7B3F7567AD-BA35-41A6-9117-FD7892D5A0DA%7D/uploads/EPT_Resolution_Final.pdf

Town of Breckenridge	CO	Our renewable energy strategies are to: - Advocate at the state level for a rapid increase in the amount of renewable energy on the grid. - Develop a local renewable energy roadmap to ensure that we maximize the use of our local resources. - Execute a community campaign to increase solar installations through education and bulk purchase programs. - Streamline the permitting process for renewable energy systems. - Collaborate with Utilities to achieve the goals of this plan. Links: Sustainable Breck Website: https://www.sustainablebreck.com/ High Country Conservation Center Climate Change: https://highcountryconservation.org/climate-change-colorado/ SustainableBreck 2019 Annual Report: https://www.flipsnack.com/sustainablebreck/sustainablebreck-annual-report-2019.html Summit Community Climate Action Plan: https://www.flipsnack.com/sustainablebreck/climateactionplan_final.html
Nederland	CO	

Appendix E: Analysis of Renewable Energy Technologies

The following is a list of renewable energy technologies which may be useful in achieving the Forest Preserves' goals of achieving 100% renewable electricity by 2030 and net-zero GHG emissions by 2050. Technologies are grouped into three tiers based on applicability, ease of implementation, and generation capacity, where the Tier 1 technologies are top priority for first consideration in implementation, Tier 2 for consideration if Tier 1 technologies do not provide the total energy requirements for Preserve operations, and Tier 3 technologies to be monitored for maturation and potential future applicability. Tier 3 technologies may also be pursued, when commercially available, as part of demonstration projects for the purposes of public engagement. See the *Renewable Energy Technologies Prioritization* section above for further details and discussion.

The tiers are defined as follows:

- **Tier 1** technologies are proven, increasingly implemented, and highly applicable, given the Forest Preserves' current assets and the context of countywide clean energy efforts, which would also have the greatest potential impact on achieving the 100% renewable electricity goal by the 2030 target date. These technologies are not necessarily the cheapest options, and some may be quite challenging from a legal, financial or political perspective. Pursuit of these technologies will still involve complex review, approval, and planning, and thus may require an extended period of time from initiation to full project implementation.
- **Tier 2** technologies are still proven and applicable, but may require additional funding, time and planning for implementation as compared to Tier I technologies. Tier II technologies may also be those with lower generation capacity that might be seen as supplemental strategies should implementation of Tier I technologies fall short of overall electricity requirements for Preserve operations.
- **Tier 3** technologies are emerging technologies which may not yet be available on the market, or which are not yet widely implemented, but might be considered now or in the future due to their potential in terms of stakeholder engagement or relation to some aspect of the Forest Preserves mission (e.g. minimal impact on wildlife or associated habitat).

Within Tier 1, on-site generation opportunities are grouped together and presented first, followed by examples of off-site generation opportunities.

TIER 1: ON-SITE RENEWABLE ENERGY TECHNOLOGIES

T1.1: Solar PV—Ground-mounted panels on Forest Preserve Property, owned by Forest Preserves

Photovoltaic (PV) system mounted on the ground which converts radiant heat and light from the sun into electricity. Components include PV modules, racking systems, cables, solar inverters and other electrical accessories.

Applicability	At strategic locations, smaller-scale installations of ground-mounted photovoltaic (PV) panels which convert radiant heat and light from the sun into electricity could meet needs for some of the Forest Preserves high-energy use facilities, and eventually, longer-term, be expanded to larger-scale installations to support energy use at multiple facilities. This strategy is particularly well-suited for the Forest Preserves because open land is an existing asset, and solar fields both large and small can be integrated into land and wildlife conservation efforts. It could also be used at some high-use locations such as the Central Maintenance Compound.
Cost	Costs will vary depending on size of installation, equipment used, grid connection complexities etc. EnergySage suggests that a 1 MW solar farm would cost roughly $1 million to install, which equates to $1.00/watt. Costs will include not only initial investment in equipment, construction, labor, permitting, and land (in the case of new acquisition), but also maintenance and end-of-life disposal. There may also be insurance costs.
Advantages	
● Land which is degraded, has low ecosystem services valuation, or is not slated to be restored for environmental or recreational value in the near future, could be targeted for solar installations. ● May allow benefits of new land acquisition to outweigh costs when considered as part of land management planning. ● Compatible with provision of pollinator habitat, which is also beneficial for various bird species and contributes to regional resiliency. Such solar site management can reduce erosion and stormwater runoff. IL is one of six states adopting pollinator-friendly solar standards, with the passing of the Illinois Pollinator-Friendly Solar Site Act in 2018. See the IDNR Solar Site Pollinator Score Card for guidance. ● Net metering could improve ROI ● Provides easily recognizable example of renewable energy efforts ● Large installations result in fewer systems needed to achieve goals, as well as decreased time spent in scoping, planning and permitting processes	

T1.2: Solar PV—Rooftop, traditional panels, owned by Forest Preserves

Photovoltaic (PV) system mounted on a building's roof which converts radiant heat and light from the sun into electricity. Components include PV modules, mounting systems, cables, solar inverters and other electrical accessories.

Applicability	Some rooftop solar systems are already in use by the Forest Preserves, including those at Swallow Cliff Pavilion and Rolling Knolls, and soon a system will be installed at Sagawau Environmental Learning Center thanks to a recently awarded grant. This strategy would make use of existing structures and provide electricity for direct use at facilities. As of 2019 the Forest Preserve's assets include over 200 roofed structures with electric connection.
Cost	Costs will vary depending on size of installation, equipment used, and whether the roof needs additional structural support. The solar installations at Swallow Cliff and Rolling Knolls cost on average $6,300/KW installed and where made possible through external grant funds. According to Energy Sage, as of August 2020 the average solar panel cost in Cook County, IL is $3.18/watt.
Advantages	
● Proven technology ● Does not require new land development ● Systems exist to integrate rooftop solar with LED lighting for buildings ● Net metering could improve ROI ● Provides easily recognizable example of renewable energy efforts	

T1.3: Geothermal—Heat pumps

Also known as a ground source heat pump, these on-site systems transfer heat from the earth into a building during the winter and back into the ground during warmer months. Several types exist, including closed-loop, horizontal, vertical, etc. The Department of Energy offers details, guidance on choosing the proper system, and insights on operations and maintenance.

Applicability	Some geothermal systems are already in use by the Forest Preserves, including those at Little Red Schoolhouse and Rolling Knolls. Additionally, a system is slated for construction as part of the new Salt Creek Landscape Maintenance headquarters.
Cost	There are three main costs to consider: equipment, drilling and installation costs. Drilling and installation costs for a system make up about 65% of the total cost of a project. According to a Department of Energy Guide to Geothermal Heat Pumps, an average geothermal heat pump system costs about $2,500 per ton of capacity. For Rolling Knolls contractors quoted an average $123,040 increase in cost for geothermal and the Forest Preserve received $35,000 in grant funds for the project.
Advantages	
● Low operating costs ● High potential for energy use reduction, tying renewable energy efforts to efficiency efforts ● Works in any climate or weather condition	

T1.4: Solar PV—Canopies, or Carports

Ground-mounted elevated structures with PV panels integrated, which can provide shade. Frequently used in parking lots (creating a carport) or other paved areas.

Applicability	Multiple parking areas are available within the Forest Preserves footprint. Technology is infrequently used in Illinois thus far, although there are large Midwest installations, such as that at Michigan State University, validating applicability here.
Cost	According to EnergySage, national level pricing on solar carport installations cost $3.93 dollars per watt for systems averaging 11.3 kW in size.
Advantages	
● Efficient use of already developed space ● Provides shade/minimal protection from elements for space users; reduce heat island effects from paved surfaces; cooler cars when used for carports, which in turn could reduce need for AC and associated emissions and fuel consumption ● Potential enhancement of rainwater collection for landscaping ● Greater ability to tilt panels to maximize production, as compared to rooftop solar ● Could be integrated with electric vehicle charging stations for Forest Preserve staff, thus contributing to goals for a fleet fueled by renewable energy. Public EV charging stations would also foster sustainable behavior among patrons and be an easily recognizable commitment to net zero energy.	

T1.5: Solar Power Purchase Agreement (PPA), with a buyout provision, on Forest Preserve Property (Solar field or rooftop)

A financial agreement to purchase electricity generated by a specific solar energy project, on property owned by the Forest Preserves. Rather than owning photovoltaic equipment, a third-party would own and operate the system, while the Forest Preserves would pay for electricity. Should the agreement include a buyout provision, and to the extent allowed by the Forest Preserves' statutory framework, the Forest Preserves could purchase the installation after year 6 which allows the third-party to takes advantage of all incentives.

Applicability	This strategy would make use of Forest Preserve land assets or facility rooftops, decreasing costs of the PPA. The early buy out option enables the Forest Preserves to confidently purchase renewable energy for the first years of partnership, save funds for a few years and buy the installation after year 6 which allows the third-party to takes advantage of all incentives.
Cost	The partnership would define the cost per kWh of energy sourced from the project. This is a low expense as the third-party partner would pay costs of installation and be responsible for maintenance for the duration of the partnership. Should the buyout provision be exercised there is no price guarantee for the fair market value of a solar installation. Berkley National Laboratory's Utility-Scale Solar report - 2019 Edition states and showcases that in the Midwest utility scale solar PPAs have a levelized price near or below $40/MWh.

Advantages

- Reduced costs both up-front and ongoing
- Any applicable rebates would go to the leasing company, potentially enabling a lower system cost at buy out
- Provides easily recognizable example of renewable energy efforts
- Compatible with provision of pollinator habitat, which is also beneficial for various bird species and contributes to regional resiliency (in the case of a solar field)
- Large installations result in fewer systems needed to achieve goals, as well as decreased time spent in scoping, planning and permitting processes

TIER 1: OFF-SITE RENEWABLE ENERGY TECHNOLOGIES

T1.6: Solar PV—Power Purchase Agreement for off-site system not on Forest Preserve Property

A financial agreement to purchase electricity generated by a specific solar energy project, not on property owned by the Forest Preserves. A third-party developer would own and operate the solar energy system and be responsible for installation, equipment purchase and maintenance.

Applicability	This can be an intermediate term (10-12 years are shortest terms) option for meeting renewable energy targets until on-site solar generation can be achieved and may be used to supplement all forms of on-site renewable energy in the long-term in order to achieve net zero energy. Note the Cook County Clean Energy Plan indicates the County plans to use PPAs.
Cost	Berkley National Laboratory's Utility-Scale Solar report - 2019 Edition states and showcases that in the Midwest utility scale solar PPAs have a levelized price near or below $40/MWh
Advantages	
● Can be rapidly implemented ● Typically electricity costs are more stable and are offered at a lower fixed rate than the utility's retail rate ● Low or no capital or maintenance costs or risks ● Third party developer could use tax credits, enabling lower pricing	

T1.7: Wind—Power Purchase Agreement for off-site system not on Forest Preserve Property

A financial agreement to purchase electricity generated by a specific wind energy project, not on property owned by the Forest Preserves. A third-party developer would own and operate the wind energy system and be responsible for installation, equipment purchase and maintenance.

Applicability	This may be a short-term option for meeting renewable energy targets until broader scale on-site renewable generation can be achieved and may be used to supplement all forms of on-site renewable energy in the long-term in order to achieve net zero energy. Note the Cook County Clean Energy Plan indicates the County plans to use PPAs.
Cost	Berkeley National Laboratory's Wind Technologies Market Report offers a Wind Power Purchase Agreement (PPA) Prices dashboard with regional and execution date filters. Accordingly, wind PPAs in the Great Lakes region have a levelized price range of $22-$40/MWh, with most within the $30-$35/MWh range.
Advantages	
● Can be rapidly implemented ● Low or no capital or maintenance costs ● Limited risk ● Third party developer could use tax credits ● Predictability of electricity ● Cost stability	

T1.8: Renewable Energy Credits (RECs)

As defined in the Cook County Clean Energy Plan, a REC is 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."

Applicability	RECs can be a short, or long-term option for achieving renewable energy goals until the Forest Preserves can generate renewable energy on-site. In the future, the Forest Preserves might sell RECs to other entities if surplus energy is generated by its own on-site renewable generation.
Cost	The cost of RECs varies based on market dynamics and demand. According to the National Renewable Energy Laboratory's Status and Trends in the U.S. Voluntary Green Power Market (2017 Data) report, voluntary unbundled REC (purchased separate from utility) prices fell by more than 50% from 2014 to 2017, and increased from $0.31/MWh in August 2017 to $0.70/MWh in August 2018, though still remain below 2014 levels.
Advantages	
● Can assist with achievement of emissions goals while supporting the renewable energy market ● Low or no capital or maintenance costs ● Limited risk ● Can instate REC sourcing limitations (Midwest vs. domestic, wind vs solar, etc.) to align with priorities	

TIER 2: ON-SITE RENEWABLE ENERGY TECHNOLOGIES

T2.1: Solar PV—Rooftop, tiles/shingles

These durable, multilayer roof coverings, are designed to look and function like conventional roofing materials (e.g. slate tiles of asphalt shingles) with integrated thin-film solar cells. Examples include Tesla Solar Roof, CertainTeed Apollo II shingles or tiles, etc. Inverters are required to convert DC to AC.

Applicability	This technology could be used on older roofs/those unable to bear weight of traditional panels, buildings with aesthetic considerations which might restrict the use of traditional panels, or smaller roofs, such as picnic pavilions.
Cost	The cost of solar shingles or tiles is typically higher than conventional panels. This option could be more cost-effective in some instances than replacement of an older roof for installation of traditional panels. Costs will vary depending on product choice, installation size, roof slope and pitch. In fall 2019, Tesla Solar Roof prices were anticipated at $42,500 for a 2000-square-foot roof with 10kW of solar capacity before tax credits (or about $21.25 per square foot). Solar shingles range in price from $21 to $25 per square foot installed.
Advantages	
● Suitable for roofs which could not withstand the weight of traditional PV panels ● Little or no impact on building aesthetics ● Net metering could improve ROI	

T2.2: Wind—Small Turbines, Horizontal Axis

Smaller systems with the main rotor shaft oriented horizontally. According to the Department of Energy, 'Small turbines range in size from 20 watts to 100 kilowatts. The smaller or "micro" (20–500-watt) turbines are used in a variety of applications such as charging batteries for recreational vehicles and sailboats. One- to 10-kW turbines can be used in applications such as pumping water.'

Applicability	There may be opportunities to install relatively small turbines on Forest Preserve properties to provide energy for buildings. This technology may be useful in conjunction with electric vehicle charging efforts.
Cost	According to Windustry.org, "Wind turbines under 100 kilowatts cost roughly $3,000 to $8,000 per kilowatt of capacity. A 10-kilowatt machine (the size needed to power a large home) might have an installed cost of $50,000-$80,000 (or more). Wind turbines have significant economies of scale. Smaller farm or residential scale turbines cost less overall, but are more expensive per kilowatt of energy producing capacity."
Advantages	
● Smaller scale turbines may be less likely to pose a risk to birds or bats, especially when strategically placed in relation to bird habitat and when taller towers are used in conjunction with shorter blades ● Could be used in conjunction with solar panels to offset inconsistent availability of both energy sources ● Proven technology ● Utilizes existing Forest Preserve properties ● Easily recognizable sign of renewable energy commitment	

T2.3: Wind—Small Turbines, Vertical Axis

Turbines in which the main rotor shaft is set transverse to the wind (but not necessarily vertically) while the main components are located at the base of the turbine. This may be free-standing, like small horizontal axis turbines (e.g. those produced by ArborWind), or integrated into buildings or other infrastructure (e.g. light poles). Inerjy's EcoVert is an additional example.

Applicability	Could be useful wherever space and wind conditions would allow a small horizontal axis turbine to be installed.
Cost	Dependent on specific type and size of vertical axis wind turbine (VAWT). Since this is a developing, not market-scale technology quotes may be obtained from specific manufacturers, such as Inerjy.
Advantages	
● Less fatigue is placed upon blades and less mechanical complexity as compared to horizontal axis turbines, which may result in reduced maintenance cost. ● May perform better than horizontal axis turbines in gusty wind. ● Suitable for small spaces ● Tend to be quieter than horizontal axis turbines ● May pose less of a threat to wildlife while improving energy harvested per square meter	

T2.4: Wind—Large Turbine, Horizontal Axis

"Typical" turbines resembling traditional windmills on a tower, like those seen in utility-scale wind farms, or relatively mid-sized single turbines at industrial facilities, which have the main rotor shaft oriented horizontally.

Applicability	Like solar PV, this may be well-suited for the Forest Preserves because open land is an existing asset, and land which is degraded, or not of significant environmental or recreational value, could be targeted for installations. However, large turbines may pose risks to wildlife which clash with the Forest Preserve mission and values. While Cook County's Clean Energy Plan includes wind energy in its definition of renewable energy, there currently are no plans to develop County-owned wind farms. There are examples of single turbines in use within Cook County, such as the 600 kW turbine at the Method manufacturing facility or the 750 kW turbine at the Testa Produce warehouse.
Cost	According to Windustry.org, "The costs for a utility scale wind turbine range from about $1.3 million to $2.2 million per MW of nameplate capacity installed. Most of the commercial-scale turbines installed today are 2 MW in size and cost roughly $3-$4 million installed. Total costs for installing a commercial-scale wind turbine will vary significantly depending on the number of turbines ordered, cost of financing, when the turbine purchase agreement was executed, construction contracts, the location of the project, and other factors. Cost components for wind projects include things other than the turbines, such as wind resource assessment and site analysis expenses; construction expenses; permitting and interconnection studies; utility system upgrades, transformers, protection and metering equipment; insurance; operations, warranty, maintenance, and repair; legal and consultation fees."
Advantages	
● Could be used in conjunction with solar panels to offset inconsistent availability of both energy sources Utilizes existing Forest Preserve properties ● Easily recognizable sign of renewable energy commitment	

T2.5: Solar Thermal Water Heating

These systems use the sun's energy to heat water for use within a building. They can be active (with circulating pumps and controls) or passive, and include storage tanks for water and solar collectors. Active systems can be classified as direct or indirect. Storage tanks are required to ensure hot water at night/when sun isn't shining. It may be advisable to maintain a traditional water heater as a backup. Whole Building Design Guide offers guidelines and complete descriptions, including types of solar collectors.

Applicability	Useful for any facility with restrooms and particularly applicable to recreation centers with swimming pools. The Department of Energy offers guidance on solar swimming pool heaters.
Cost	Dependent upon the exact type of system considered. The Whole Building Design Guide suggests new construction systems have better economics due to reduced installation expenses; that site also includes information on operations and maintenance. Costs will include maintenance and repair in addition to installation, and possibly training of current staff for new system requirements. See Estimating Cost and Energy Efficiency of Solar Water Heater from the DOE (geared toward residential systems).
Advantages	
● Opportunity to simultaneously consider renewable energy strategies, energy efficiency efforts and water use and tracking goals ● Extremely efficient ● Solar thermal collectors take up less space than traditional PV panels	

TIER 3: RENEWABLE ENERGY TECHNOLOGIES

T3.1: Solar PV-Façade or Cladding

PV panels mounted on an existing building façade, rather than on the roof, or cladding with integrated solar cells

Applicability	Applicable to existing buildings, particularly those without proper conditions to support rooftop solar.
Cost	Costs will depend on specific products chosen and installation size. The Onyx Solar web site describes the costs of it solar glass cladding as "EUR 100 per sqm ($12US/sqFt) and makes EUR 500 ($55US/sqFt) per sqm installed on the façade."
Advantages	
● Could be used to revitalize older buildings ● Could allow more optimal placement of PV (e.g. south-facing side of buildings) ● Reduced loss of generation due to snow in winter months, as compared to rooftop panels. ● Easily recognizable sign of renewable energy commitment	

T3.2: Solar Windows

Replacement for traditional windows which can convert the sun's energy to electricity. Existing windows can be retrofitted to solar windows through application of solar film.

Applicability	Applicable to existing buildings with windows, particularly those without proper conditions to support rooftop solar. Generation capacity is not as great as a strategy like a solar field, though, so this should be seen as a potential supplemental approach or demonstration project.
Cost	In 2016, Sharp solar windows cost $2,000 per square meter.
Advantages	
● More efficient use of currently developed space; requires no new land development ● Could allow more optimal placement of PV (e.g. south-facing side of buildings) ● Can work with natural, shaded or indoor light ● Could possibly power a device charging station to stimulate conversation or raise awareness of renewable energy efforts	

T3.3: Solar Blinds

External blinds for building windows with integrated PV panels. This technology can generate electricity while simultaneously blocking heat, thus reducing cooling costs and energy usage in warmer months. SolarGaps, for example, automatically track the sun. A motor and inverter are necessary in addition to the blinds themselves.

Applicability	Could be used on buildings where rooftop panels are not feasible, but due to low generation potential, this would be more of supplemental strategy or a demonstration project that a main strategy.
Cost	Still an emerging technology, pricing for SolarGaps is available via the Quote form on their web site.
Advantages	
● Illustrates innovation ● Could possibly power a device charging station to stimulate conversation or raise awareness of renewable energy efforts	

T3.4: Solar Paint or Spray-on Solar Cells (non-window)

There are three types of solar paint - hydrogen-extracting solar paint, quantum dot solar cells also known as photovoltaic paint, and perovskite solar paint - of which are emerging technologies, and the aforementioned solar windows use a form of quantum dot photovoltaic "paint." The opportunity in this scenario entails paint on a building façade or other structure.

Applicability	Not currently available for commercial applications, this is instead a strategy to monitor for possible future consideration.	
Cost	N/A as this technology is not currently commercially available.	
Advantages		**Notes**
● Could turn any built surface into part of the renewable energy generation network		● Emerging technology not currently available commercially.

T3.5: Kinetic—Electricity Generating Pavers and Floors

Paving tiles with integrated electromagnetic generators, which generate electricity from tile displacement caused by the weight of walking upon the tile. Learn more about How it Works from Pavegen and this Fully Charged episode.

Applicability	Could be integrated into sidewalks or high-traffic paved trails, possibly to power associated outdoor lighting. Could also be integrated into outdoor athletic recreation areas (e.g. basketball or tennis courts) or playground areas.
Cost	An article from 2016 on the Dupont Circle project states "The project — which transformed a sad swath of cement overlooking Connecticut Avenue by adding 194 kinetic pavers, sleek stone benches and flower beds — cost nearly $300,000, city officials said. About $100,000 of that went to Pavegen, officials said, adding that the city spent roughly the same amount for underground and other site work to support the high-tech system. The balance, including $33,000 from the Golden Triangle Business Improvement District, went to completing the project."
Advantages	
● High potential for public engagement and demonstration ● According to Pavegen, can "produce around 3 joules of energy per footstep or up to 5 watts of power while someone is walking, enough to power applications such as environmental sensors, LED lighting and screens and for storage in batteries." ● "Installations provide data on how much energy is being generated and when. With Low-Power Bluetooth beacons, Pavegen floors can also communicate with users' smartphones, providing rich customer analytics data via a permission-based rewards system."	

T3.6: Wind—Small Turbines, Bladeless

Capitalizing on a phenomenon of vorticity called vortex shredding, these turbines turn the kinetic energy of oscillating or vibrating into electricity. They include no gears or bearings. Concept being worked on by Vortex Bladeless.

Applicability	This is a technology that may allow relatively cheap integration of on-site wind generation into Forest Preserve operations in the future.
Cost	According to Vortex Bladeless web site, they "expect Vortex Tacoma models to have a similar price to medium-high production solar panels."
Advantages	
● Potentially safer for wildlife ● Possible lower upfront and maintenance costs	

T3.7: Microbial Fuel Cells

Alternative sanitation option which uses urine to produce electricity via microbial fuel cells.

Applicability	Could be used in place of typical portable outhouses for outdoor events. Such systems have been used at the Glastonbury Festival in the UK since 2015 and in refugee camps. Might also be integrated into restroom facilities.
Cost	Not yet commercially available. Visit Robial and the Bristol BioEnergy Center for further information.
Advantages	
● High potential for public engagement and demonstration ● Added potential benefit of reducing pathogens in wastewater	

Contributors

PRINCIPAL AUTHORS

April Janssen Mahajan
Project Lead/Sustainability Specialist
Illinois Sustainable Technology Center
Prairie Research Institute
University of Illinois at Urbana-Champaign

Joy Scrogum
Assistant Scientist, Sustainability
Illinois Sustainable Technology Center
Prairie Research Institute
University of Illinois at Urbana-Champaign

Savannah Feher
Sustainability Technician
Illinois Sustainable Technology Center
Prairie Research Institute
University of Illinois at Urbana-Champaign

Shantanu Pai
Assistant Sustainability Researcher
Illinois Sustainable Technology Center
Prairie Research Institute
University of Illinois at Urbana-Champaign

Anthony D. Tindall
Policy & Sustainability Manager
Forest Preserves of Cook County

FOREST PRESERVES
OF COOK COUNTY

Arnold Randall
General Superintendent

Eileen Figel
Deputy General Superintendent

GREEN SUSTAINABILITY LEADERSHIP TEAM:

Chair:
Anthony D. Tindall
Policy & Sustainability *Manager*

Ecological Sustainability Working Group Chair:
Charles O'Leary
Deputy Director of Resource Management

Energy & Transportation Working Group's Chair:
Tom Rohner
Director of Facilities & Fleet Maintenance

Internal Operations Working Group Chair:
Lydia Uhlir
Project Analyst

Learning & Engagement Working Group Chair:
Heather Anderson
Graphic Designer

Zero Waste Working Group Chair:
Elizabeth Millan
Director of Landscape Maintenance

OTHER CONTRIBUTORS:

Tracy Bishop, *Manager of Permits & Revenue*

Mary Busch, *Volunteer Program Specialist*

Tom Conlon, *Purchasing Agent*

James Havlat, *Chief Building Architect*

Stephen Hughes, *Chief Finance Officer*

Charmaine John, *Sustainability Fellow*

David Kircher, *Chief Landscape Architect*

Katie Moriarty, *Program Specialist*

Lori Nayman, *Building Architect*

Derrick Nelson, *Warehouse Manager*

Maritza Rocha, *Director of the Little Red Schoolhouse Nature Center*

Susan Rohner, *Project Coordinator*

Chris Slattery, *Director of Planning & Development*

Jacqui Ulrich, *Director of Conservation & Experiential Programming*

Michelle Uting, *Grant Administrator*

Tim Weber, *Building Architect*

Kathy Wurster, *Finance Manager*

External Advisors

Kate Buczek
Energy Consultant,
Cook County Bureau of Asset Management

Sarah Edwards
Community Outreach Coordinator,
Cook County Department of Environment & Sustainability

Elizabeth Granato
Interim Bureau Chief,
Cook County Bureau of Asset Management

Lanetta Haynes Turner
Chief of Staff
Cook County-Office of the President

Bilqis Jacobs-El
Director of Facilities Management,
Cook County Bureau of Asset Management

Jennifer Martin
Environmental Program Development Specialist
Illinois Sustainable Technology Center
Prairie Research Institute
University of Illinois at Urbana-Champaign

Jamie Meyers
Energy Manager,
Cook County Bureau of Asset Management

Deborah C. Stone
Chief Sustainability Officer,
Cook County Department of Environment & Sustainability

Disclaimer

To the extent this document mentions or discusses statutory or regulatory authority, it does so for informational purposes only. This document does not substitute for those statutes or regulations, and readers should consult the statutes or regulations to learn what they require. Neither this document, nor any part of it, is itself a statute, ordinance, rule, or regulation. Thus, it cannot change or impose legally binding requirements on the Forest Preserves. Further, any expressed intention, suggestion or recommendation does not impose any legally binding requirements on the Forest Preserves. The Forest Preserves' decision makers remain free to exercise their discretion in choosing to implement the strategic actions, objectives, goals, and recommendations described in this Clean Energy Framework. Their implementation is contingent upon availability of resources and any required board approvals, and are subject to change.

Citation

ILLINOIS
Prairie Research Institute
Prairie Research Institute. 2021.
Clean Energy Framework for the Forest Preserves of Cook County.

University of Illinois at Urbana-Champaign, Champaign, IL.

About the Forest Preserves of Cook County

Don't you sometimes just want to escape? Explore the natural beauty of Cook County for an hour, a day or even a night. When you're surrounded by 70,000 acres of wild and wonderful, there's no better place to feel free.

It's a place where plants and animals thrive
Although Cook County is one of the most densely populated areas in the country, it is the most ecologically diverse county in Illinois. Our prairies, woodlands, wetlands and savannas are home to native plants and wildlife, including more than a hundred threatened or endangered species.

Forest Preserves of Cook County
General Headquarters
536 N Harlem, River Forest, IL 60305

Forest Preserves of Cook County
536 N. Harlem Avenue, River Forest, IL 60305