



Moving Towards 100% Renewable Electricity Powering Minneapolis Operations by 2022

August 21, 2017

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Powering Minneapolis Operations by 2022

Executive Summary:

The purpose of this report is to fulfill the requirements of City Council Action 2017A-0491 in which Property Services staff was directed to produce a “preliminary analysis and recommendations on steps necessary for the City of Minneapolis enterprise to obtain 100% of its electricity usage from renewable sources within five years. The analysis for the City enterprise should include current and projected usage of electricity over the next 10 years as a result of factors such as:

1. Reduced demand for electricity such as LED lighting, changes to water storage and distribution systems, new building enhancements, and improvements to existing facilities.
2. New City facilities and consolidation of the City’s real estate.
3. Potential increase in usage pursuant to the current study for the potential of new electric vehicles in the City’s fleet.

The report is divided into four sections:

1. Definitions of “renewable energy” and the concept of Renewable Energy Credits.
2. A review of current renewable electricity purchased by the City.
3. An outline of how the City could change its sources of electricity to claim that the City operations are powered by 100% renewable electricity.
4. A review of current electrical usage patterns by the City, and predictions on reductions in electricity usage that can be obtained in the next five years.

In summary, by 2022 the City can significantly increase the amount of renewably sourced electricity from the current 17.9% to slightly above 90% with a mix of Xcel Energy WindSource and Renewable Connect programs and solar installations on City owned buildings and land. The remaining approximately 10% would be Community Solar Gardens where the Renewable Energy Credits are owned by Xcel Energy. Using today’s available technology, the City should be able to reduce its total electricity usage from 102 million kWh by 15% to 86 million kWh by the year 2022.

Decisions that the City Council needs to make at this time:

1. Does the City continue to seek out Community Solar Garden subscriptions? Property Services staff was authorized in 2016 to sign subscription agreements up to a total of 12 million kWh a year. The staff has signed agreements totaling 7.5 million kWh. Every additional subscription agreement that the City signs will mean more electricity used by the City which cannot be legally counted as renewable energy for the City since the current Solar Garden Tariff has the renewable energy credits (RECs) for all new gardens mandated to be owned by Xcel Energy.
2. Does the City want to utilize land at Water Treatment Facilities for City owned solar arrays where the RECs would be owned by the City? It is estimated that there is enough space at Water Treatment Facilities to install solar array totaling 6 million kWh annually (6% of current annual usage). The payback on these arrays would be ~13 years and would require \$10 million to \$12 million in initial capital investment.
3. Does the City increase its Renewable Connect contract from 17.8 million kWh by another 50 million kWh immediately? The Renewable Connect program tariff limited the City to 10% of the total electricity available in the program. Xcel Energy is planning to ask the Public Utility Commission to lift the 10% cap since the program still has 62 million unassigned kWh. A 50 million kWh contract would increase the City’s Xcel charges by \$250,000 - \$500,000 annually, equaling a 2.4% - 4.8% increase in annual charges. A 50 million kWh contract would bring the City to 67% renewable electricity for its municipal operations.

Section 1: Renewable Energy and Renewable Energy Credits (RECs):

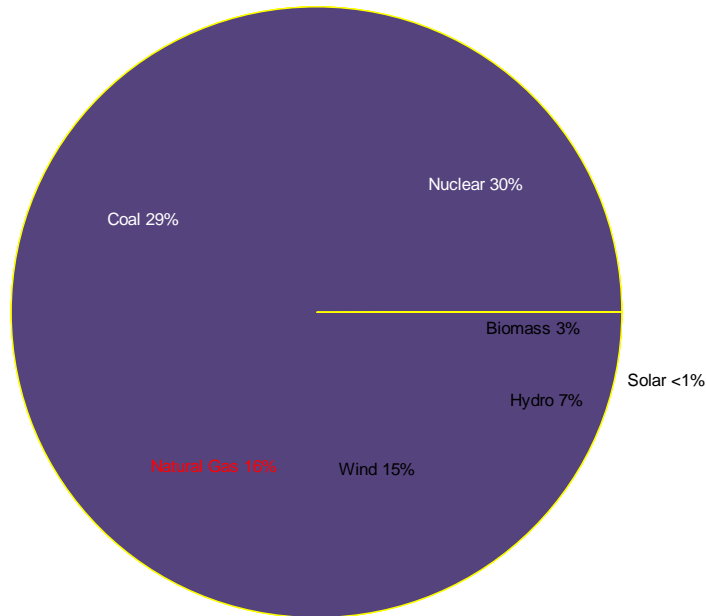
Renewable electricity is being generated in the United States from four main sources:

1. Hydro Power – electricity generated from dams on rivers

2. Wind Power – electricity generated from wind farms
3. Solar Power – electricity generated from photovoltaic solar arrays
4. Biomass – electricity generated from waste vegetation and wood scrap.

Xcel Energy produces electricity from all four renewable sources listed, as well as from fossil fuels and nuclear fuels. For 2016, the mix of generation for the electricity sold by Xcel Energy is shown in Figure 1:

Figure 1: Energy Sources for Xcel Electricity 2016



To be included in this chart, the electricity from renewable sources must have its Renewable Energy Credits (RECs) assigned to Xcel Energy. The possession of the RECs is the universally recognized requirement to state that a facility or organization is powered by renewable electricity. This mix of resources allows Xcel Energy to state that their Minnesota territory electricity is 25% renewable.

The Minnesota legislature has mandated that Xcel Energy’s resource mix must be 30% renewable by 2020. The City currently assists Xcel Energy in moving towards this goal in two specific ways:

1. A series of solar arrays that the City installed on the Convention Center, Fire Station 4, Fire Station 19, the Haaf Ramp, and the Currie Maintenance facility. These arrays received rebates and subsidies from Xcel Energy with the stipulation that the RECs would be assigned to Xcel. This amounts to 835,000 kWh annually (0.8% of the City’s electrical usage).
2. The City has signed 24 Community Solar Garden subscription agreements totaling 7.5 million kWh annually (7.4% of the City’s electrical usage). All of the electricity generated by these gardens has its RECs assigned to Xcel.

Section 2: Renewable Electricity Currently Purchased by the City:

The City has three sources of electricity totaling 17.9% of its annual usage where the RECs are owned by the City:

1. A solar array at the Royalston Maintenance Facility that did not receive any Xcel Energy subsidies or rebates. This array generates 110,000 kWh annually.

2. The participation in Xcel Energy's WindSource program for 300,000 kWh each year at the Hiawatha Maintenance Facility.
3. The participation in the recently created Xcel Energy Renewable Connect program. The City is now starting to receive 17.8 million kWh each year from this program's mix of wind and solar resources.

Section 3: Steps Needed to Reach 100% Renewable Electricity in Five Years (2022):

For the City to reach its goal of 100% renewable sources by 2022 where the RECs are owned directly by the City, it will have to adopt a mix of the following strategies:

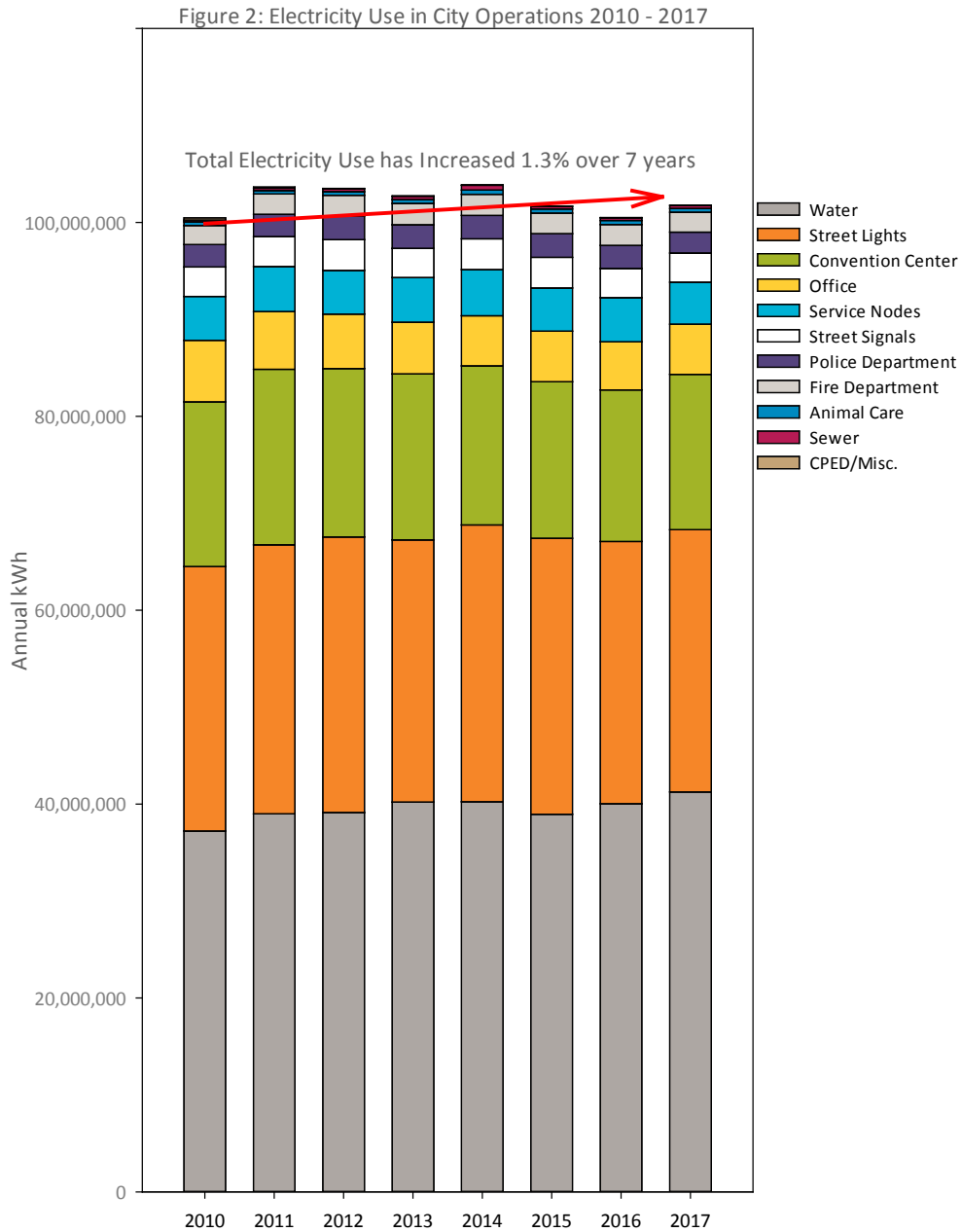
1. Obtain more renewable energy directly from Xcel Energy via the WindSource or Renewable Connect program or any new program that the utility creates where the renewable energy credits to the electricity accrue to the City and not the utility (6% - 12% increase in electricity cost).
2. Install more solar arrays on a variety of City owned buildings without utilizing any Xcel Energy rebates or subsidies (13 year payback).
3. Enter into an agreement with Xcel energy where the electricity from a renewable generation source not on City property can be purchased directly from the generator and transmitted over the Xcel energy distribution grid (Payments to Xcel for transmission costs).

These three steps will not bring the City to its goal of 100% renewable electricity by 2022. The City will still have to contend with the Community Solar Garden subscriptions of 7.5 million kWh annually. These are 25 year contracts, obligating the City to subscribe until 2042. As the City implements more energy conservation measures, these subscriptions will become an even larger portion percentage of our electricity, approaching 9% by 2022. Unless the City terminates these agreements, at substantial costs, it will only have the potential to obtain and "claim" 91% renewable electricity by 2022.

Section 4: Past, Current, and Future Electrical Usage by the City:

The City of Minneapolis currently uses between 100 million and 102 million kilowatt hours of electricity each year in its operations at an annual cost of \$11,000,000 to \$12,000,000. For the purposes of this report, “municipal operations” are defined as street lights and signals, Water Treatment/Distribution/Sewer, and all buildings owned by the City excluding parking ramps, parking lots, and the Target Center. The ramps and Target Center have not been included since these are properties that are not managed on a day to day basis by City staff. The three areas of street lights and signals, Water Treatment/Distribution/Sewer, and buildings have averaged 30%, 39%, and 31% of the purchased electricity over the past eight years respectively.

Figure 2 shows the electricity usage by various City departments from 2010 through the projected usage for 2017:



As can be seen in the chart, the total electricity usage has fluctuated from 100 million to 102 million kWh annually. These values are not weather normalized, i.e. the effects of year-to-year weather changes were not taken into account. Colder winters result in increased hot water circulation pump usage, and warmer summers result in increased air conditioning equipment usage. Using the year 2010 as a baseline for predicting future electricity usage, the weather normalized prediction for 2017 is 105,850,000 kWh. The City is well below this number through the end of June and it is calculated that the total for 2017 will be 101,700,000 kWh, avoiding 4,150,000kWh due to conservation measures taken over the past eight years. These conservation measures have included:

1. Converting all indoor fluorescent lighting to more efficient fluorescent lighting in 2010.
2. Installed the most efficient HVAC equipment available when remodeling any buildings or when units fail.
3. Doubling the amount of roof insulation when re-roofing any buildings and installing white roofs to lower air conditioning demands.
4. Reapplying weather stripping to all doors and windows.
5. Installing Energy Star appliances when remodeling any buildings or when units fail.
6. Converting all fluorescent lighting to more efficient LED lighting in 2017.
7. Upgrading building automation systems to more tightly control building HVAC conditions.
8. Installing fast acting dock doors at the Convention Center.
9. Replacing 1000 street lights with LED light fixtures.

While the total amount of electricity has remained relatively constant since 2010, there is a marked difference in the electricity usage patterns between the City's buildings and the City's provided services. Figure 3 illustrates the changes to the electricity usage by the various types of City buildings from 2010-2017 and Figure 4 illustrates the same changes in usage by the City's services:

Figure 3: City Owned Facilities Electricity Usage

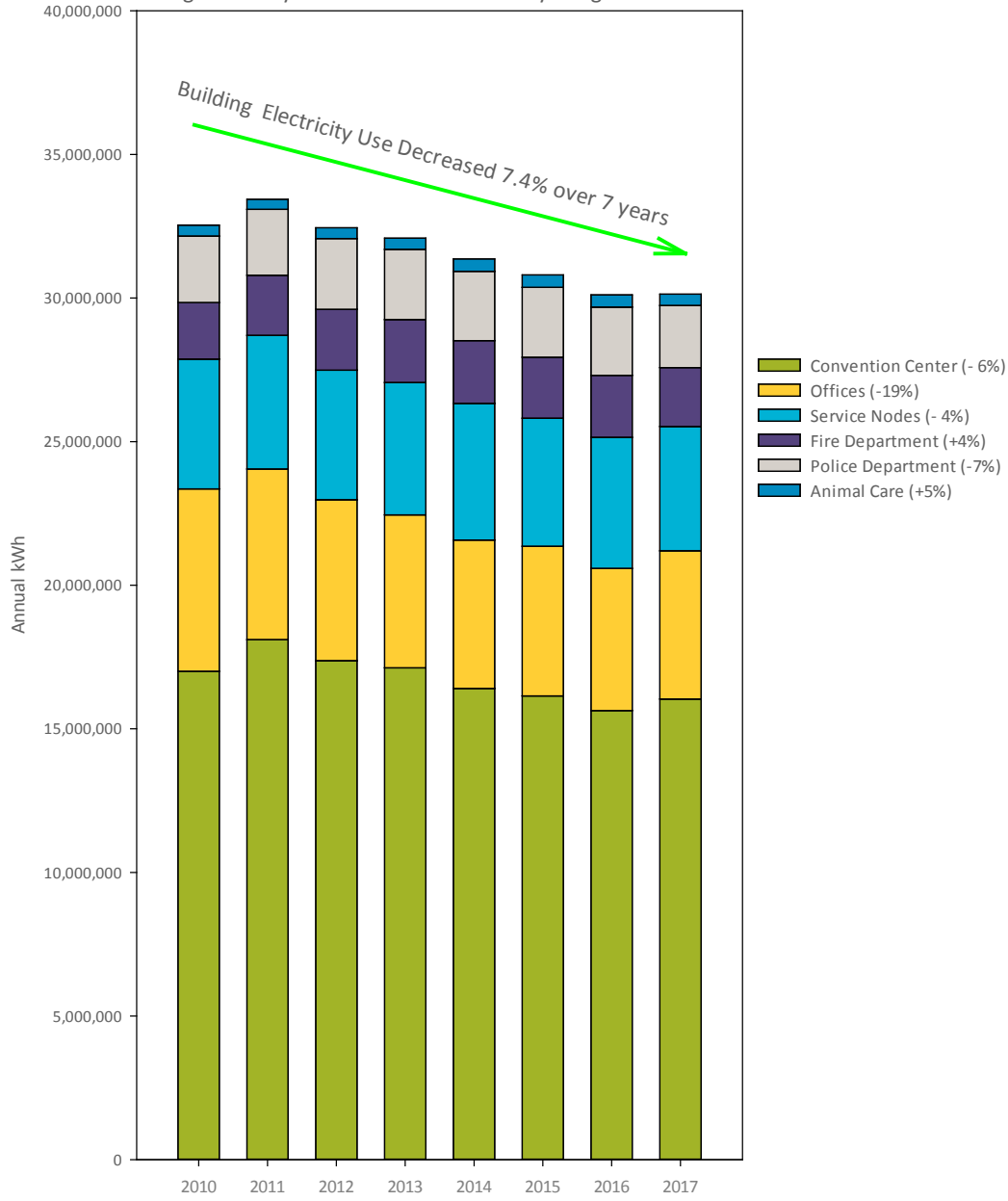
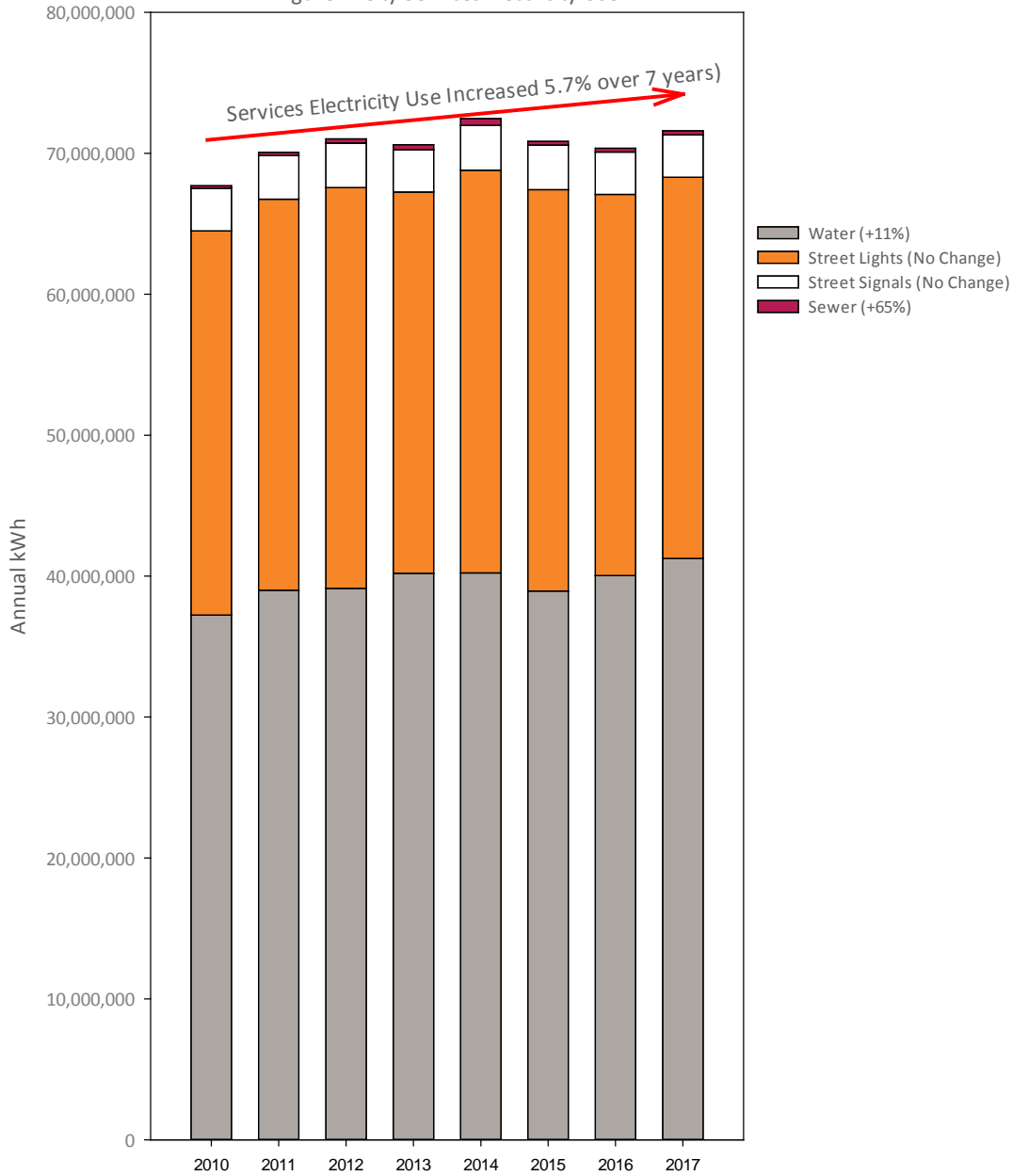


Figure 4: City Services Electricity Use



An example of the decreases in building electricity usage is the Convention Center. Compared to its peak usage in 2011, the Convention Center used 13% less electricity while renting out 3% more space in 2016. This was achieved by converting all of the main exhibit halls and the mezzanine exhibit halls to LED lighting. The Convention Center is now beginning the replacement of all incandescent and fluorescent lamps in the meeting rooms and main concourses, which will reduce their consumption by another 1 million kWh each year.

The Services electricity consumption increase was due to increases at the Water Treatment Facilities. Some of this increase is due to 2010 usage being artificially low as the Columbia Heights membrane and filter plants were fully shut down for the first half of the year for major process tankage cleaning, inspection, and module replacement. This resulted in a major shift loads to other facilities which may have been more energy efficient but had very different process performance. The Water Department continues to monitor pump performance and rebuild pumps to maintain their efficiency. They are also beginning the process of changing all lighting to LED fixtures.

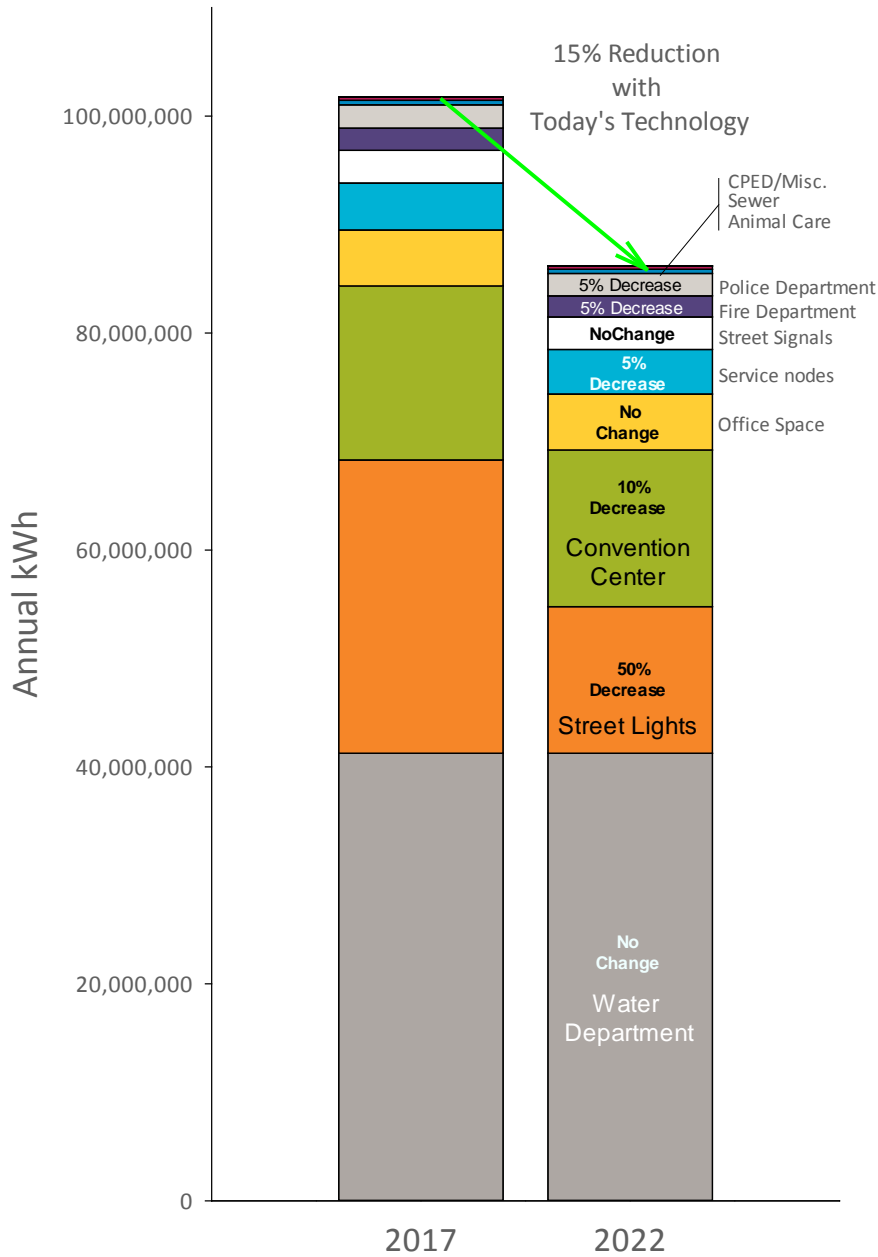
Street Lighting and Street Signals electricity usage has basically been constant for many years due to the fact that very few new lights are added each year and the lamp technology has been the same for the past 20 years. Starting in 2017, however, the technology is changing to LED fixtures for street lights. Xcel Energy has committed to replacing all of its 18,000 wood pole mounted light with LED's within five years, and the City has begun the replacement of its 12,000 metal pole mounted street lights. These two replacement programs will result in a 50% decrease in electricity used for street lighting. Street signals have been using LED lamps for many years, so no decreases are expected in this area.

The technology exists today to reduce the City's electricity consumption by an additional 15% by 2022 down to a total usage of 85 million to 86 million kWh:

1. Continue conservation measures listed above during renovation of existing buildings (400,000 kWh reduction).
2. Complete transition from fluorescent to LED indoor and outdoor lighting at the Convention Center (1,000,000 kWh reduction).
3. Xcel Energy completes the conversion of their 18,000 wood pole street lights from HID and HPS lamps to LED lamps (8,150,000 kWh reduction).
4. The City converts the remaining 11,000 of its street lights to LED lamps (5,000,000 kWh reduction).

Figure 5 illustrates these areas of reduction:

Figure 5: Future Electricity Usage in City Operations



There will be areas where electricity consumption will remain steady or actually increase over the next five years. The planned construction of the East Side Storage and Maintenance Facility, the Hiawatha Campus expansion, and the Consolidated Office Building project will replace older less efficient facilities with the latest in energy saving technology. However, the amount of square footage to be heated and cooled will increase. In addition, the Consolidated Office Building will relocate City staff that are currently working at leased facilities. None of the leased facilities are included in the energy usage numbers in this report, so this will increase the number of staff that need heated and cooled work space. The assumption at this time is that all of these facility changes will result in office space electricity usage remaining constant from 2017 through 2022. It is assumed that continued conservation efforts at our existing service nodes will bring about a 5% reduction in electricity usage by 2022.

Another small area of increased electricity usage will be the expected replacement of gasoline powered vehicles with electric vehicles. The City currently owns 75 sedans which are the most likely

type of vehicle that would be replaced with electric vehicles, and each of these were driven an average of 4,250 miles per year. Electric vehicles are currently averaging 3 miles for every kWh of electricity stored, so if all 75 vehicles were replaced, they would consume approximately 110,000 kWh a year (0.1% of the City's total electricity usage).