City of Hendersonville

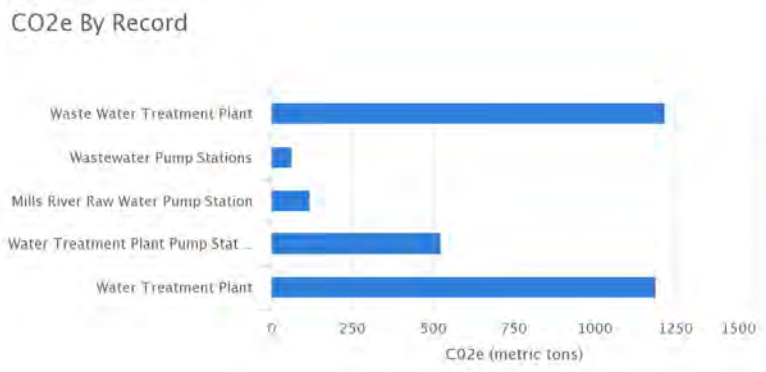
Environmental Sustainability Board

2021 Energy Overview

Current energy utility providers:

Duke Energy (all other energy used for building, streetlights, and traffic signals)

- Total energy consumption:
    - 12,350 MWh/year
    - 3,602 MT CO2e
- Dominion Energy (natural gas for heating)
    - 83,230 therms
    - 442.67 MT CO2e
- **NOTE: 77% of the total energy consumption for the City is derived from water and wastewater treatment, pumps, and facilities. Keep in mind water and wastewater treatment services municipal operations, city residents, county residents, and any other customers. Since the City owns and operates this utility (unlike solid waste), it is the City's responsibility to account for this total energy use in a greenhouse gas assessment.**
    - Breakdown:



Notes:

- CO2e is calculated by summing the three gases, CO2, CH4, and N2O and applies the global warming potential values to CH4 and N2O to express records in terms of CO2 equivalent.
- Energy audits are in the works for the Water Treatment Plant and City Operations Center
- In terms of available grants, the only ones I have seen are for low income and/or residential community solar or are only available for larger municipalities. Keep that in

mind with proposals to council; funding would likely have to come from the City and not reliant on grant funds.

Attachments:

- Greenhouse gas assessment overview
- Duke Energy 2022 breakdown (note, this document wasn't available for 2021 numbers but can be used to get an idea of Duke's energy breakdown and trends).
- 2022 Solar feasibility study
- 2018 energy audit for City Hall
- Water & Sewer sustainability initiatives (many projects relating to energy)

Considerations for proposed policy from Caitlyn/staff liaison:

- Minimum energy efficient standards for municipal buildings (this is something that is on my to-do list that I would like to work on but I am more than happy to have ESB take the lead. Thus far this would just be for municipal buildings but if the board would like to focus on the commercial and residential sectors, that could be how we break up the responsibilities with me working on the municipal side).

Greenhouse Gas Assessment

In order to ensure this Plan has measurable results, a greenhouse gas assessment was completed to identify the largest sources of emissions. Assessments like these are commonly used in municipal sustainability planning to provide a benchmark of our starting point and how we would like to improve as we look to the future.

Greenhouse gas emission reduction is a necessary step in ensuring a resilient economy, environment, and community.

GHGs are gases in the earth's atmosphere that trap heat and keep our planet warm enough to sustain life. GHGs include carbon dioxide, methane, nitrous oxide, and fluorinated gases. Since the 1900's, Human activity such as burning fossil fuels has caused a dramatic increase in these gases and the trend has rapidly accelerated in recent years. When too much heat is trapped, overall temperature rises. This results in destructive weather patterns that include flooding, drought, and other natural disasters.

Note:

Water & Wastewater Treatment was calculated for city-wide uses since it is City owned and operated while Buildings & Street Lights and Vehicle Fleet are specific to the municipal operational level.

Solid waste was not included in the GHG assessment since the City does not have tracking on what is produced only for municipal operations. Furthermore, the City does not own or operate the waste transfer station or landfill. Municipal solid waste is also expected to be very small. For informational purposes, the total CO2e for City-wide solid waste is 2,208 MT CO2e.

This Sustainability Plan will help the City mitigate these challenges while realizing cost savings and improved quality of life.

For this assessment, 2021 City emissions were used as a benchmark to measure our progress and goals. 2021 is the most recent year where emission factor sets are available for measuring.

What process was used to create the GHG Assessment?

This assessment was completed through ICLEI: Local Governments for Sustainability, which is a global network of more than 2,500 local and regional governments committed to sustainable urban development. ICLEI's ClearPath model was used to complete a local government operations protocol for the quantification and reporting of greenhouse gas emissions inventories.

What was included in our GHG Assessment?

Buildings & Streets

This sector includes the emissions from energy used to operate City owned buildings, streets, and traffic signals.

Fleet

Included are the emissions from on-road and off-road vehicles used for municipal operations ranging from garbage trucks to administrative vehicles for staff. The specific types of fuel and miles are tracked as well as the vehicle size.

Wastewater & Water Treatment

This sector accounts for the emissions from the wastewater treatment process, from pumping water to treating wastewater and drinking water,

Process & Fugitive Emissions

These emissions calculate the amount of methane that is leaking out of pipes during distribution of natural gas.

Solid waste is an important aspect of sustainable practices even though it is not included in the City's GHG assessment based on the reasons found on page 7. As a result, proposed waste reduction actions are included within this strategic plan to ensure we are making strides in reducing the City's solid waste consumption.

How do you measure GHGs?

Greenhouse gases are measured in carbon dioxide equivalent otherwise known as CO2e. Various greenhouse gases ranging from carbon dioxide, methane, nitrous oxide, hydrochlorofluorocarbons, and more. These gases are then converted to the amount of carbon dioxide in metric tons that would cause the same amount of atmospheric warming.

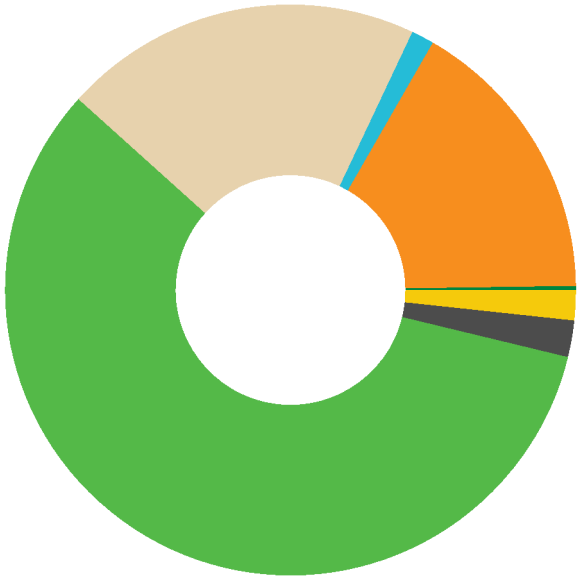
CITY OF HENDERSONVILLE - CUSTOMER

Duke Energy Carolinas

Generation Mix

YOUR 2022 TOTAL USAGE: **12,345** MWh

- 0.2% (Biomass)*
- 16.5% (Coal)
- 1.3% (Hydro)*
- 20.4% (Natural Gas)
- 57.9% (Nuclear)*
- 2.1% (Fuel/Oil)
- 1.7% (Solar)*



** Carbon-free sources*

2022 Carbon Intensity

584

lbs CO_2/MWh

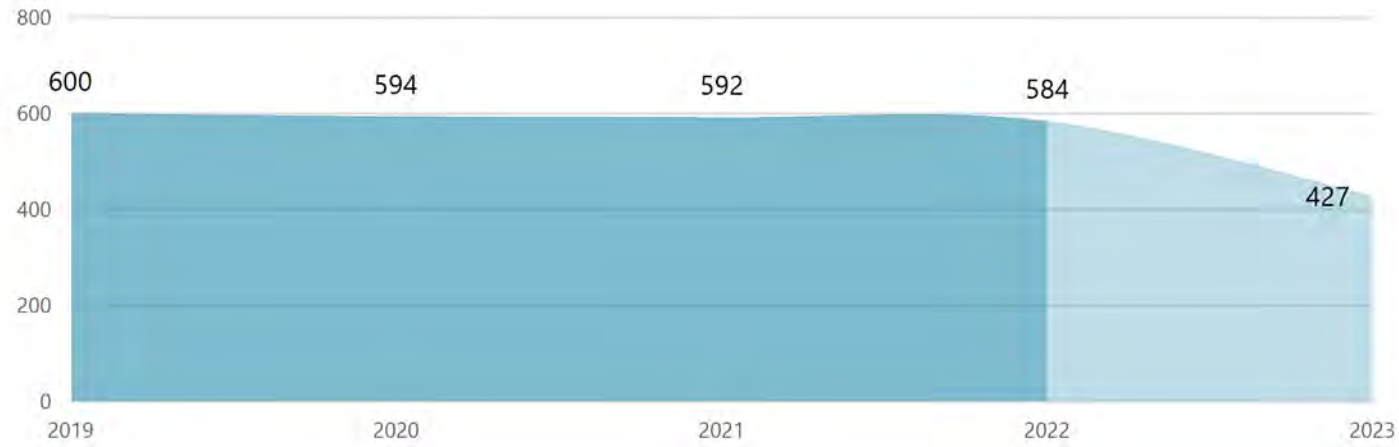
Forecast Model: Forecasting models for 2023 Carbon Intensity based on Duke Energy's Integrated Resource Plan.

Usage Data & Generation Mix: Usage data and generation mix are based on the selected calendar year. Actual usage from billing data and generation mix are used when available, otherwise projections are used to provide this reasonable snapshot.

Based on your usage and Duke Energy's carbon intensity, your 2022 carbon emissions are **7,209,199** lbs CO2

Carbon Intensity

(lbs CO_2/MWh)



Historical | Projected

Duke Energy CO_2 Emissions Reduction Goals | **By 2030** cut CO_2 emissions by at least 50% | **By 2050** attain net-zero CO_2 emissions

For options how to further impact your carbon emissions, just ask your Large Account Manager!

Report Generated By: Russo, Matt | Matt.Russo@duke-energy.com

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Phone: 828-492-0677
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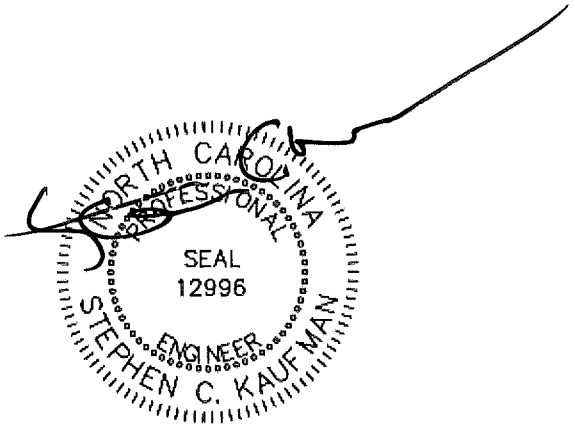
PHOTOVOLTAIC SYSTEMS FEASIBILITY STUDY

FOR

THE CITY OF HENDERSONVILLE, NORTH CAROLINA

CITY HALL AND OPERATIONS CENTER FACILITIES

OCTOBER 26, 2022



Hendersonville City Hall/Operations Center PV study

According to PVWatts Calculator (nrel.gov), the following solar characteristics can be used to estimate solar panel power production in this region:

- Average efficiency for Hendersonville's zip code: 14%
- Solar radiation available for PV panels: 1kW/sq. meter

Therefore, estimated solar power production is: 140 W/sq. meter of panels installed.

City Hall

Site info: Area of parking spaces (est.): 352 sq. meters

The solar calculator estimated the following monthly power production:

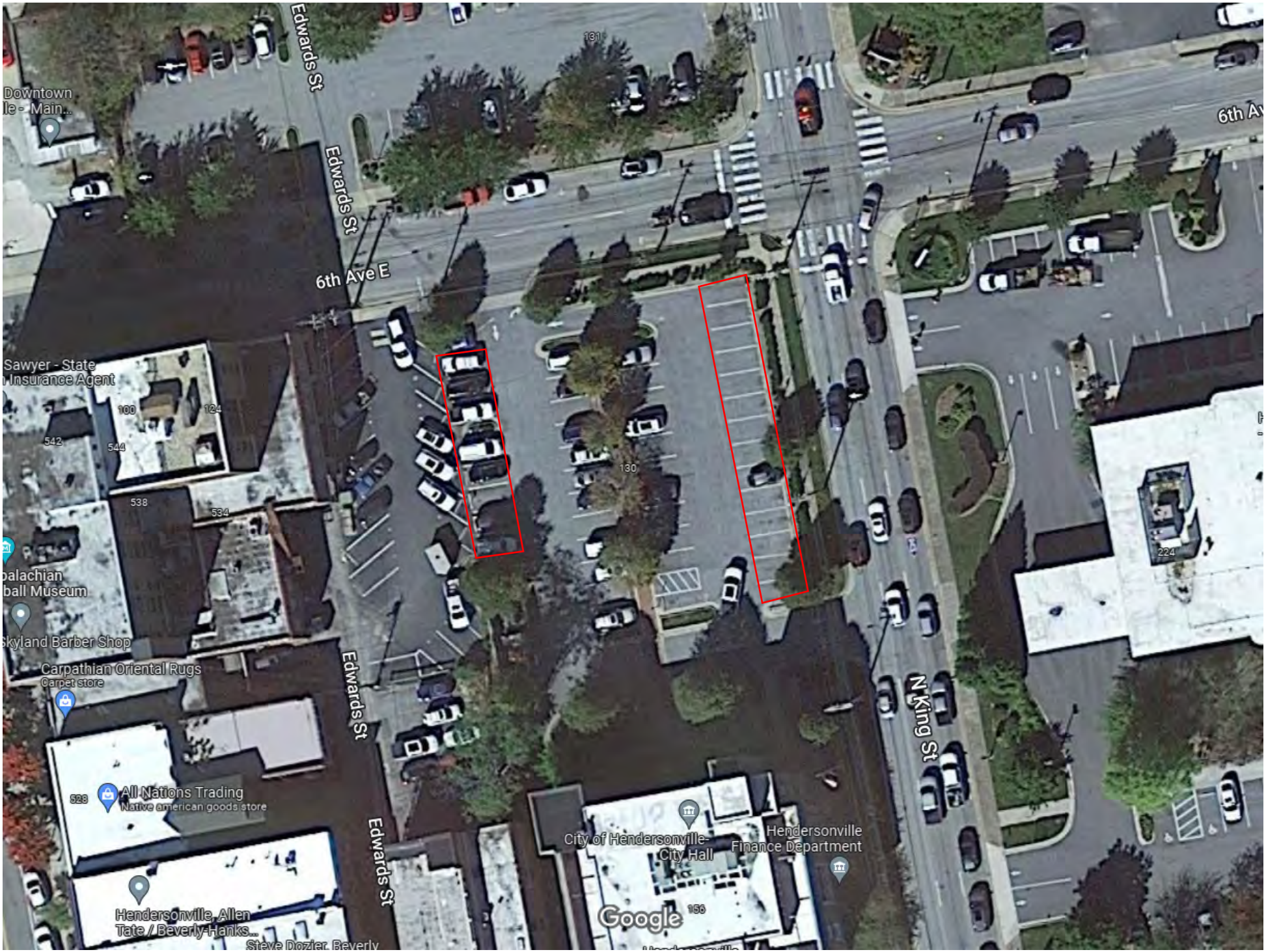
year	month	est. Solar output (kWh)
2021	9	6,532.82
2021	10	5,645.70
2021	11	4,702.40
2021	12	3,690.43
2022	1	4,031.16
2022	2	4,545.95
2022	3	6,072.57
2022	4	6,894.44
2022	5	7,426.04
2022	6	7,489.45
2022	7	7,506.63
2022	8	7,223.87
	Total (kWh)	**71,761.46**

To estimate new power demand and payment, the estimated solar output above was subtracted from the past year's power consumption for both city hall and parking ops. The same rates were used for the residual demand. This would best demonstrate monthly power cost if solar panels were installed and functioning as expected:

year	month	Existing power bill	new power bill
2021	9	$ 3,013.48	$ 2,315.65
2021	10	$ 2,069.50	$ 1,559.86
2021	11	$ 1,552.55	$ 1,149.04
2021	12	$ 1,587.06	$ 1,233.00
2022	1	$ 1,454.01	$ 1,103.95
2022	2	$ 1,805.85	$ 1,166.65
2022	3	$ 1,835.61	$ 1,129.09
2022	4	$ 1,827.51	$ 1,066.03
2022	5	$ 1,923.45	$ 1,306.24
2022	6	$ 2,919.51	$ 1,990.32
2022	7	$ 2,895.66	$ 1,954.49
2022	8	$ 2,766.50	$ 2,036.83
Total		**$ 25,650.69**	**$ 18,011.14**

Total estimated savings over the year: $7,639.55

Reference area layout for panels:


Edwards St
6th Ave E
N King St
Sawyer - State Insurance Agent
Carpathian Oriental Rugs
Carpet store
All Nations Trading
Native american goods store
Hendersonville, Allen Tate / Beverly-Hanks...
City of Hendersonville-City Hall
Hendersonville Finance Department
Google
100
124
542
544
538
534
528
130
131
156
224

Operations Center

Current site info: Area of parking spaces (est.): 395 sq. meters

The solar calculator estimated the following monthly power production:

year	month	est. Solar output (kWh)
2021	9	7,192.77
2021	10	7,064.73
2021	11	5,917.94
2021	12	5,034.75
2022	1	5,873.99
2022	2	5,945.44
2022	3	7,649.42
2022	4	7,555.21
2022	5	8,364.17
2022	6	8,041.70
2022	7	7,713.88
2022	8	7,798.38
	Total (kWh)	**84,152.37**

To estimate new power demand and payment, the estimated solar output above was subtracted from the past year's power consumption for both city hall and parking ops. The same rates were used for the residual demand. This would best demonstrate monthly power cost if solar panels were installed and functioning as expected:

year	month	Previous power bill	new power bill
2021	9	$ 1,654.93	$ 1,013.47
2021	10	$ 1,341.74	$ 716.99
2021	11	$ 1,096.29	$ 580.36
2021	12	$ 1,082.38	$ 625.78
2022	1	$ 1,123.66	$ 620.88
2022	2	$ 1,142.06	$ 636.44
2022	3	$ 1,188.94	$ 561.11
2022	4	$ 1,119.76	$ 464.99
2022	5	$ 1,320.06	$ 601.31
2022	6	$ 1,924.96	$ 1,226.18
2022	7	$ 2,048.34	$ 1,379.91
2022	8	$ 1,914.26	$ 1,242.11
Total		**$ 16,957.38**	**$ 5,145.27**

Total estimated savings over the year: $11,812.11

Reference area layout for panels:


Williams St
122
Williams St
5
City Operation Center
Williams St
Hendersonville Engineering
451
Williams St
Google
Catherine Gillet

Operations Center- Future lot PV study

In order to be in compliance with Duke Energy, there are certain criteria that have to be taken into consideration. Their requirements for solar power production are such as the maximum power generation at any time cannot exceed the peak demand of the building. Due to the yearly fluctuation of solar power production, any additional solar in the future lot could risk exceeding maximum demand in its peak production season. Therefore, it is our recommendation that solar canopies are not installed in this lot.

Cost estimations:

Canopy solar pricing appears to be quite limited in this area. Therefore, we utilized online estimates. These are not an actual indication of the true cost of construction and installation. Prices may vary.

Reference: How Much do Solar Canopies Cost? | EnergyLink (goenergylink.com)

Estimated price per watt: $3.45 to 3.99$

Cost with this estimate:

- City hall (53kW): $182,850-211,470
- Operations Center (59.2 kW): $204,240-295,408

Reference: Solar Carport Cost 2022 | Avg Price Per Watt - AE, LLC (powersolarphoenix.com)

Estimated price per watt: $3.72

Cost with this estimate:

- City hall (53kW): $197,160
- Operations Center (59.2 kW): $220,224

Reference: Solar Carports: What They Are And Benefits (greenlancer.com)

Estimated price per watt: $3.45

Cost with this estimate:

- City hall (53kW): $182,850
- Operations Center (59.2 kW): $204,240

Based on these estimates, the initial cost range of these arrays are:

City Hall: $182,850-211,470

Operations center: $204,240-295,408

Simple Payback period

With these estimations, the payback period range is:

City hall: 18-25 years

Operations Center: 24-28 years

Business Partner Id: 1102498263

From Date: 10/01/2021 to Date: 09/30/2022

Charge Bill Year	Charge Bill Month	Contract Account Name	Premise Street Address	Premise State	Total Dollars	Total KWH	Cost Per KWH
2021	9	CITY OF HENDERSONVILLE	305 WILLIAMS ST	NC	$1,654.93	20,869.88	$0.0741
2021	10	CITY OF HENDERSONVILLE	305 WILLIAMS ST	NC	$1,341.74	16,511.24	$0.0759
2021	11	CITY OF HENDERSONVILLE	305 WILLIAMS ST	NC	$1,096.29	13,645.76	$0.0751
2021	12	CITY OF HENDERSONVILLE	305 WILLIAMS ST	NC	$1,082.38	13,204.20	$0.0766
2022	1	CITY OF HENDERSONVILLE	305 WILLIAMS ST	NC	$1,123.66	14,379.24	$0.0730
2022	2	CITY OF HENDERSONVILLE	305 WILLIAMS ST	NC	$1,142.06	14,736.00	$0.0724
2022	3	CITY OF HENDERSONVILLE	305 WILLIAMS ST	NC	$1,188.94	15,453.40	$0.0719
2022	4	CITY OF HENDERSONVILLE	305 WILLIAMS ST	NC	$1,119.76	13,601.88	$0.0769
2022	5	CITY OF HENDERSONVILLE	305 WILLIAMS ST	NC	$1,320.06	16,483.08	$0.0748
2022	6	CITY OF HENDERSONVILLE	305 WILLIAMS ST	NC	$1,924.96	25,239.16	$0.0713
2022	7	CITY OF HENDERSONVILLE	305 WILLIAMS ST	NC	$2,048.34	27,597.32	$0.0694
2022	8	CITY OF HENDERSONVILLE	305 WILLIAMS ST	NC	$1,914.26	25,492.20	$0.0702
2021	9	CITY HALL	160 6TH AVE E	NC	$3,013.48	36,684.48	$0.0768
2021	10	CITY HALL	160 6TH AVE E	NC	$2,069.50	29,172.96	$0.0663
2021	11	CITY HALL	160 6TH AVE E	NC	$1,552.55	22,544.56	$0.0644
2021	12	CITY HALL	160 6TH AVE E	NC	$1,587.06	21,849.52	$0.0679
2022	1	CITY HALL	160 6TH AVE E	NC	$1,454.01	21,526.40	$0.0631
2022	2	CITY HALL	160 6TH AVE E	NC	$1,805.85	21,024.00	$0.0708
2022	3	CITY HALL	160 6TH AVE E	NC	$1,835.61	23,604.96	$0.0644
2022	4	CITY HALL	160 6TH AVE E	NC	$1,827.51	23,370.96	$0.0647
2022	5	CITY HALL	160 6TH AVE E	NC	$1,923.45	27,187.60	$0.0661
2022	6	CITY HALL	160 6TH AVE E	NC	$2,919.51	33,574.96	$0.0763
2022	7	CITY HALL	160 6TH AVE E	NC	$2,895.66	32,628.64	$0.0778
2022	8	CITY HALL	160 6TH AVE E	NC	$2,766.50	34,059.52	$0.0759

Waste Reduction Partners

ENERGY ASSESSMENT

City of Hendersonville
City Hall

CONFIDENTIAL REPORT PREPARED BY:

Waste Reduction Partners

ASSESSMENT TEAM:

Tom Wooten, Hendersonville Public Works Director
Larry Reeves, Hendersonville Building Maintenance Supervisor
Terry Smith, Hendersonville Building Maintenance Technician
Jean Young, Hendersonville Accounts Payable
George Tregay, Waste Reduction Partners
Barry Hanak, Waste Reduction Partners

SPONSORED BY:

NC Department of Environmental Quality
Division of Environmental Assistance
and Customer Service

EPA

EPA United States Environmental Protection Agency

DATES:

Survey: May 23, 2018

Report: June 26, 2018

Disclaimer

This report is intended to convey information and guidance for identifying opportunities and options for organizational improvements, energy reduction and cost savings. Neither any WRP team member, the Land of Sky Regional Council (LOSRC), nor any funding agency shall be held liable for any statements, written or oral, included in this report, nor be held liable for any damages resulting from the assessment reported herein. Compliance with environmental and occupational safety and health laws is the sole responsibility of each business. All legal and regulatory references within this document are intended only for informational purposes and are not to be taken as reliable sources of legal reference. Clients should contact the appropriate legal and regulatory authorities for current regulatory requirements as well as for interpretation and implementation. All references and vendor materials (when available) mentioned in the report are included in this disclaimer. Mention of a vendor, brand name, or manufacturer does not represent an endorsement by LOSRC, the WRP program, nor any funding agency. Neither the LOSRC, WRP personnel, nor the authors of this report are responsible for practices or procedures implemented by individual firms. Recommendations are given as options only and are to be implemented by the firm at its discretion.

The value of any assessment is dependent upon the number of recommendations implemented. Waste Reduction Partners provides its services at no or reduced cost to the customer and is funded by grants and donations from various governmental and industry constituents. All clients are encouraged to evaluate the value of this service and consider supporting Waste Reduction Partners to continue providing this valuable service to other NC organizations. Tax-deductible donations can be made to the "Land of Sky Regional Council" to support the work of Waste Reduction Partners.

This report was prepared for:
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This report was prepared by:
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www.wastereductionpartners.org

Land of Sky Regional Council
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Barry Hanak, bhanak@wrpnc.org

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Assessment - Executive Summary

Introduction

The City Hall for Hendersonville is located on 5th Avenue East. Tom Wooten, Director of Public Works, requested that Waste Reduction Partners conduct an energy and water assessment of the City Hall. Larry Reeves, Building Maintenance Supervisor, and Terry Smith, Building Maintenance Technician, escorted George Tregay and Barry Hanak of Waste Reduction Partners (WRP) on a walk through assessment of the building on May 23, 2018. Jean Young, Accounts Payable, provided information on the electric billing.

Facility Description

The City Hall was built in 1928, but has been remodeled extensively with many aspects dating from 2000 or more recent. The building area was estimated to be 30,895 sq. ft. on four floors. The first floor is accessed from the parking lot and is used by the customer service department and the police (24/7). The second floor has the original entrance on 5th Avenue, a large lobby, City Council Chambers, and administrative functions. The third floor has offices for city departments. The fourth floor was originally the jail, but has been completely remodeled for Police Department offices.

Occupancy of the building is about 20 staff in Administration, Finance and Human Resource departments, present about 50 hours per week. The Police Department has a staff of about 55 with operations 24/7 from the City Hall. Police officers are working outside the building a portion of the time. To gage building the building usage, it was assumed that there was an average occupancy of 8 police staff for 168 hours per week.

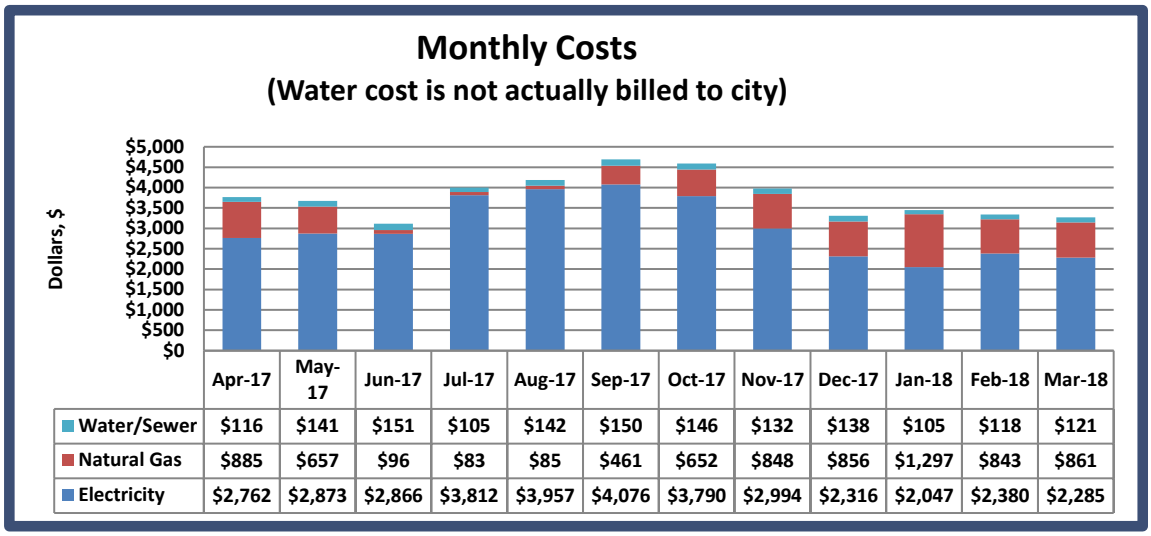
Summary of Energy Benchmarks

The average energy consumption per square foot (Energy Index) of heated and cooled space is about 83 thousand Btu/sq.ft./year. That value is similar to that for an office building. Considering the 24/7 operation of the police department, the assessors judge the overall efficiency to be very good.

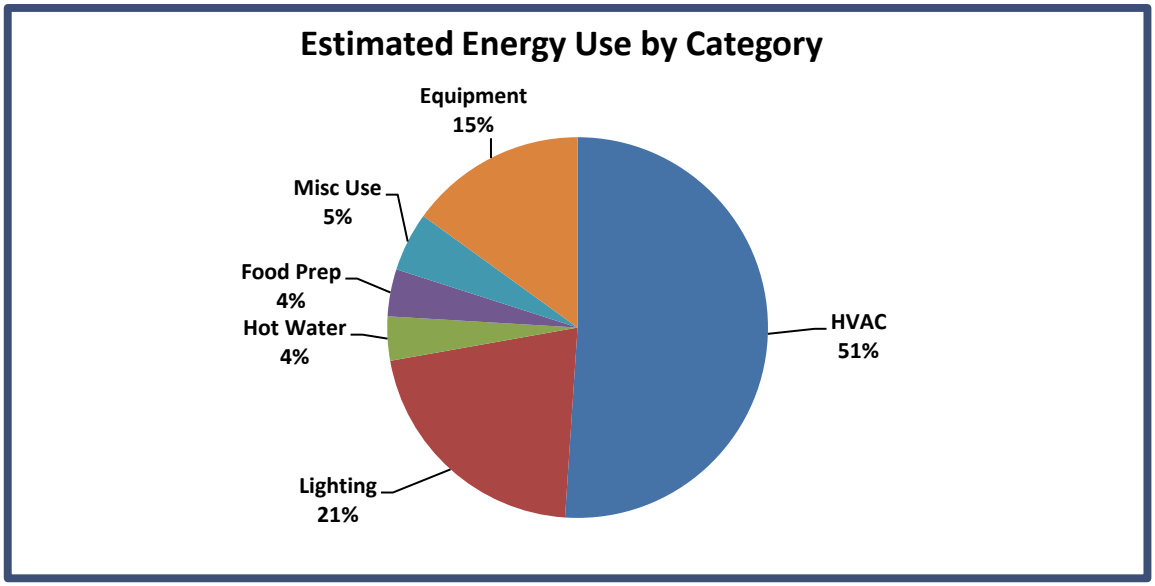
Hendersonville does not charge itself for water and sewer. For this report, however, these costs were calculated to give a value to the effective benefits of water efficiency measures.

The monthly costs are shown below and the estimated distribution of energy usage illustrated in the pie chart.

Summary of Energy Benchmarks		
Total Energy Consumed:	2,572	Million Btu / yr
Total Energy Index:	83	kBtu / sq ft / yr
Total Energy Cost:	43,784	$ / yr
Total Energy Cost Index:	1.42	$ / sq ft / yr



	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18
Water/Sewer	$116	$141	$151	$105	$142	$150	$146	$132	$138	$105	$118	$121
Natural Gas	$885	$657	$96	$83	$85	$461	$652	$848	$856	$1,297	$843	$861
Electricity	$2,762	$2,873	$2,866	$3,812	$3,957	$4,076	$3,790	$2,994	$2,316	$2,047	$2,380	$2,285



Summary of Findings and Recommendations

Estimated Annual Cost & Energy Savings			
Energy Cost Savings, $ / Year	$3,369	Electricity Savings, kWh/yr.	44,800
Water Cost Savings, $ / Year	$472	Natural Gas Savings, Therms/yr.	77
Total Cost Savings, $ / Year	$3,840	Fuel Oil Savings, Gallons/yr.	0
Energy Savings, MMBTU / Year	161	Propane Savings, Gallons/yr.	0
		Water Savings, Gallons / Year	55,163

Estimated Annual Emissions Reductions	
Carbon Equivalent, (CO_2e) - Greenhouse Gases, Pounds/Year	49,272
Nitrogen Oxides, (NO_X) - Precursor to Ozone, Pounds/year	37
Sulfur Oxides, (SO_X) - Contributes to Acid Rain, Pounds/Yr	91

Summary of Recommendation Measures

Energy Efficiency Recommendations	Cost Savings / yr.	Investment Cost	Payback Period (yr)	mmBtu Saved
Upgrade recessed can lights from CFL to LED	$193	$992	5.2	9
Upgrade 4 ft. fluorescent fixtures to LED	$3,176	$17,220	5.4	144

Water Efficiency Recommendations	Water Saved (gal/yr)	Cost Savings per Year	Investment Cost	Payback Period (years)	mmBtu Saved/yr
Replace the aerators in the 19 bathroom sinks with 0.5 gpm aerators.	12,906	$151	$95	0.6	7
Replace the two showers with 2.0 gpm units.	1,825	$21	$20	0.9	1
Replace the current 1.6 gpf toilets with 1.28HE gpf toilets.	7,008	$52	$7,650	TBD	0
Replace the current one gpf urinals with 0.125 gpf urinals.	28,744	$213	$2,700	TBD	0
Reduce flowrate in kitchen sink to 1.5 gpm	4,680	$35	$5	0.1	0
Totals for Energy		**$3,369**	**$18,212**		**153**
Totals for Water	**55,163**	**$472**	**$10,470**		**8**
GRAND TOTALS FOR ALL RECOMMENDED EFFICIENCY MEASURES		**$3,840**	**$28,682**		**161**

Optional Measures and Future Choices

City Hall has received multiple upgrades and has a high level of energy efficiency. HVAC upgrades are already planned and not included in this report. The T8 fluorescent and CFL lighting is reasonably efficient, however, LED technology has made tremendous advances and should be considered for further energy use reductions.

The City has already converted to LED fixtures at the Operations Center and Fire Station. The assessors recommend a follow up evaluation of lessons learned before starting on the City Hall. For example, did the LED fixtures cause any areas to become overlit? A review of before and after electric usage for Operations Center and Fire Station is encouraged. How well do the reductions at Operations and Fire Station correlate with expectations of the LED upgrade? This information will allow a more informed evaluation of proposed LED upgrades to City Hall.

Assessment Report

Background

The City of Hendersonville has a population of 14,000 with the City Hall located on 5th Avenue East. Tom Wooten, Director of Public Works, requested that Waste Reduction Partners conduct an energy and water assessment of the City Hall. Larry Reeves, Building Maintenance Supervisor, and Terry Smith, Building Maintenance Technician, escorted George Tregay and Barry Hanak of Waste Reduction Partners (WRP) on a walk through assessment of the building on May 23, 2018. Jean Young, Accounts Payable, provided information on the electric billing.

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Occupancy of the building is about 20 staff in Administration, Finance and Human Resource departments and they would be present about 50 hours per week. The Police Department has a staff of about 55 with operations 24/7 from the City Hall. Police officers are working outside the building a portion of the time. To gage building the building usage, it was assumed that there was an average occupancy of eight police staff for 168 hours per week.

Energy Efficiency Recommendations

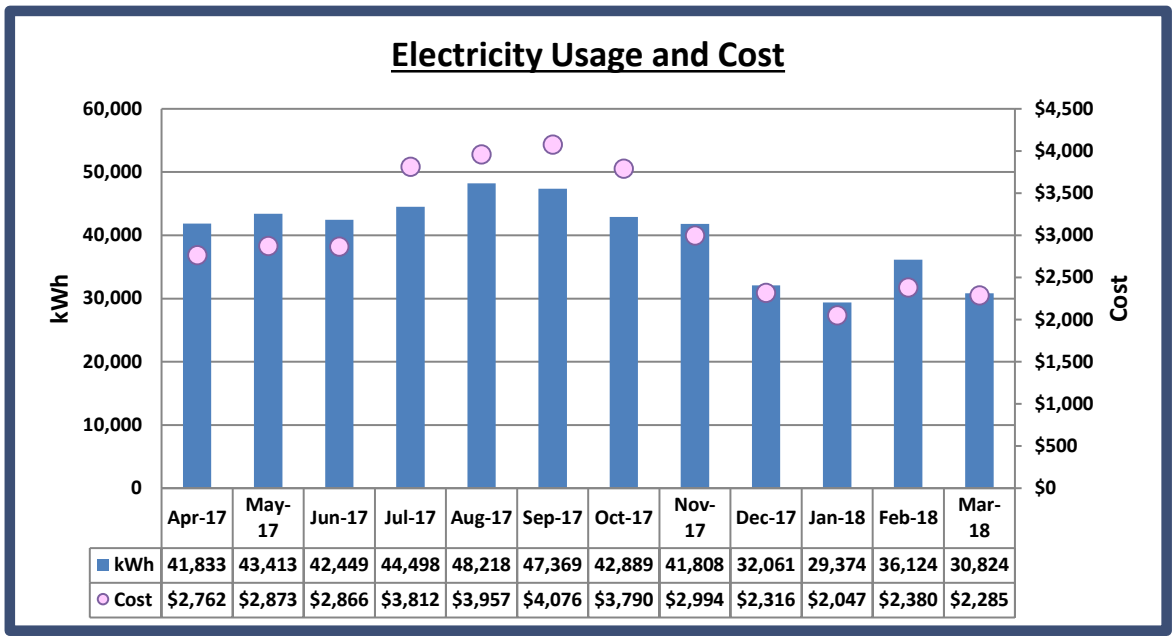
Utility Use Analysis

Electricity accounts for 64% of the energy usage and is purchased from Duke Energy Carolinas under the OPT-V Time-Of-Use Secondary General Service schedule. A total of 480,860 kWh was used from April 2017 to March 2018 at a cost of $36,159. The billing is broken down into the following categories:

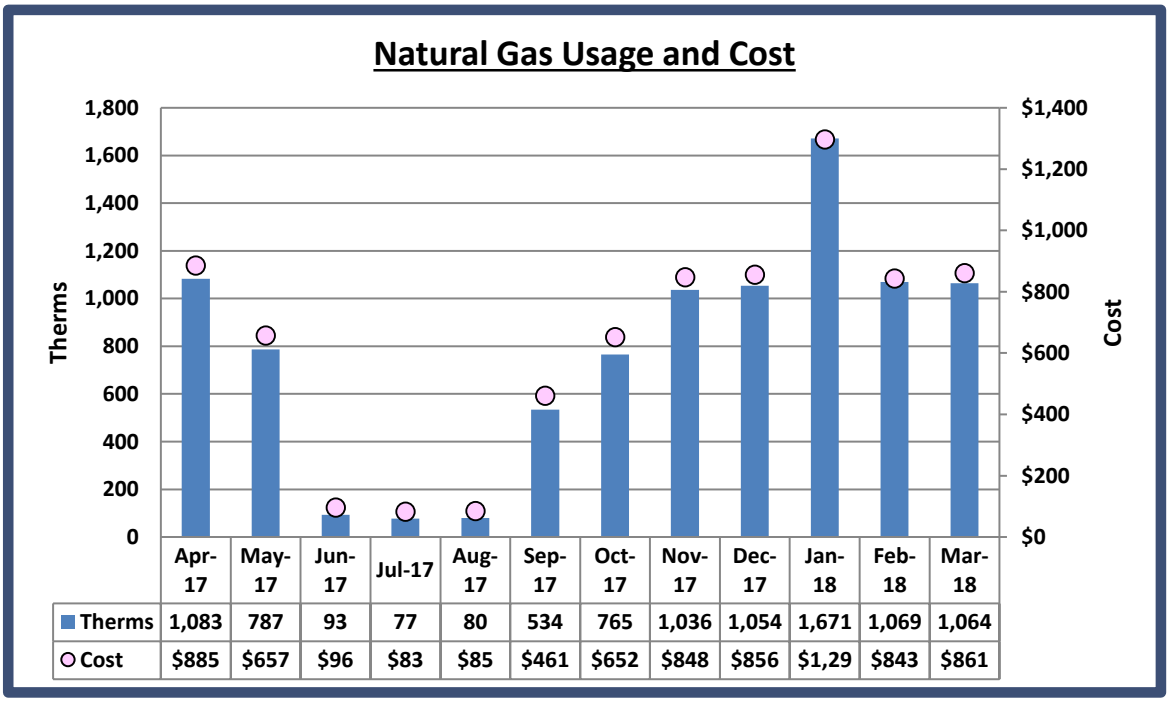
Basic Facilites charge	$32.17	
Demand Charge per kW	$16.6190	June 1 – September 30 (Summer)
	$9.0765	October 1 – May 31 (Winter)
Energy Charge per kWh	$0.06284	On-Peak Mon/Fri (1 to 9 PM Summer), (6 AM to 1 PM Winter)
	$0.03386	Off-Peak All other weekday hours, Saturday, Sunday, and holidays
Renewable energy rider and 7% sales tax		

During the winter, the effective rate is about $.07 per kWh; however, the high demand rate in the summer raises the effective rate to about $0.085 per kWh. Air conditioning causes the highest usage and is charged at the higher rate. Thus, upgrading air conditioning (planned) will have the largest impact on electric cost.

Natural gas accounts for 36% of the energy usage and is purchased from PSNC. A total of 9,313 therms were consumed in the last year at a cost of $7,625. The usage is primarily for heating as illustrated in the figure below.



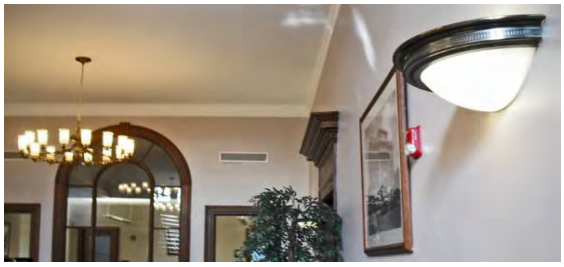
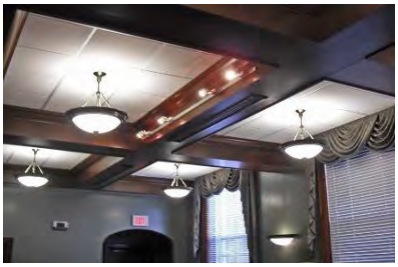
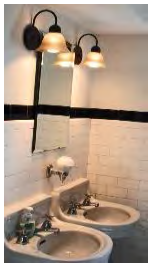
	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18
kWh	41,833	43,413	42,449	44,498	48,218	47,369	42,889	41,808	32,061	29,374	36,124	30,824
Cost	$2,762	$2,873	$2,866	$3,812	$3,957	$4,076	$3,790	$2,994	$2,316	$2,047	$2,380	$2,285



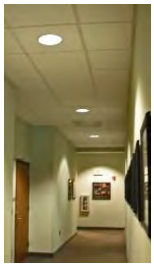
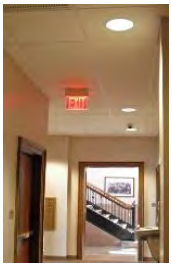
	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18
Therms	1,083	787	93	77	80	534	765	1,036	1,054	1,671	1,069	1,064
Cost	$885	$657	$96	$83	$85	$461	$652	$848	$856	$1,29	$843	$861

CFL Lighting Details - Upgraded to LED

The building has a wide variety of architectural light fixtures that use CFL bulbs. These are best addressed by identifying an LED replacement and installing when the CFL bulb burns out.

There are an estimated 32 can fixtures in the hallways. If these are upgraded as a group with a LED upgrade kit, then rebates can be utilized.

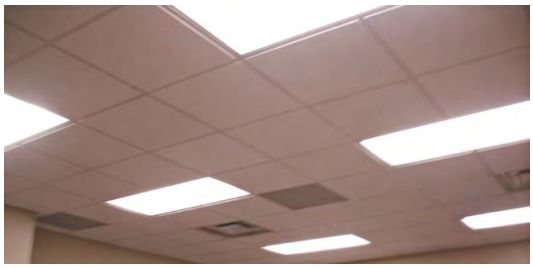
Details of Recommendations - Incandescent Lighting Upgraded to LED

Upgrade for Incandescent Lighting to LED			Energy Savings				Cost Comparison						Payback
							Investment Cost			Annual Savings			
Location Key	Before	After	Watt Red'n Per Lamp	Est. Hours ON per Year	No. of Lamps to be Repl'd	KWH Saved Per Year	Material	Labor	Total	Energy	Maintenance	Total	Years
	CFL can	LED kit	16.0	5,000	32	2,560	$672	$320	$992	$193	$0	$193	5.2
				TOTAL	**32**	**2,560**	**$672**	**$320**	**$992**	**$193**	**$0**	**$193**	**5.2**

Contact a lighting supplier for recommendations and pricing on a LED kit that would provide an acceptable light level. There is a huge variety of products available with widely varying pricing. The values listed above are an example assuming replacing 32 26 W CFL bulbs with a 10W LED kit costing $25 with $10 labor and a $4 rebate. The 5,000 hours per year is a guess assuming some hallways are lit all the time and some are shut off at night. The Duke rebate assumes the kit is on the Design Lights Consortium list or Energy Star list (may be listed under fixtures-recessed lighting).

Fluorescent Lighting Details - Upgraded to LED

The majority of the fixtures are for 4 ft. fluorescent tubes. These are in troffer fixtures in suspented ceiling or hanging in strip type fixtures.



LED kits have been developed that reduce four 32 W lamp fluorescent fixture (128 W) to less the 32 W total. Installation can take less than ten minutes. This type of upgrade is recommended for the troffer fixtures.

It was estimated that there are approximately 80 additional 4 ft. fluorescent tubes in a variety of fixtures (strip, stairwell, bathroom). These can be upgraded on a tube for tube basis with an energy reduction of about 50%. There are two types of LED tubes on the market: those that use a ballast compatible with the fluorescent tube and a "ballast bypass" version where the LED is wired directly to line voltage. The ballast bypass is not recommended because of the safety issue if a fluorescent tube is installed in a fixture without a ballast.

A further caution is verify that the fixture wiring (series/ parallel, shunted/nonshunted) is compatible with the LED tube. In addition, the ballast needs to be on the LED manufacturers approved list to validate the warranty.

Details of Recommendations - Fluorescent Lighting Upgraded to LED

Upgrade for Fluorescent Lighting to LED			Energy Savings				Cost Comparison						Payback
							Investment Cost			Annual Savings			
Location Key	Before	After	Watt Red'n Per Lamp	Est. Hours ON per Year	No. to be Repl'd	KWH Saved Per Year	Material	Labor	Total	Energy	Maintenance	Total	Years
	Troffer	LED kit	68.0	3,200	180	39,168	$12,420	$3,600	$16,020	$2,945	$0	$2,945	5.4
	Strip	LED tube	16.0	2,400	80	3,072	$1,200	$0	$1,200	$231	$0	$231	5.2
TOTAL					**260**	**42,240**	**$13,620**	**$3,600**	**$17,220**	**$3,176**	**$0**	**$3,176**	**5.4**

Vendor quotes are needed to obtain quantities and costs. The upgrades were roughly estimated with the following assumptions.

For each troffer, the fluorescent tubes and ballasts would be replaced by a $105 LED kit with $20 labor and $36 Duke rebate. The 68 W reduction assumes a 50/50 mix of two and four tube fluorescent fixtures are replaced an average of 28 W LED kit. The 3,200 hours reflect the mixed use of the rooms the troffers are located in.

LED tubes for the various types of strip fixtures can be purchased for less than $10. This report, however, uses a conservative estimate of $18 per tube to allow for the possible need to replace the ballast. Labor was assumed to be with City staff. The Duke rebate is $3 per tube.

HVAC Details

There are already plans for a major upgrade to HVAC equipment so this assessment did not address this area. The Fulton boiler is 14 years old and is in good working order.

Water Heating Details

There is a single gas Lochinvar water heater. No recommendations; however, be sure to evaluate higher efficiency models when replacement is needed.

Envelope Details

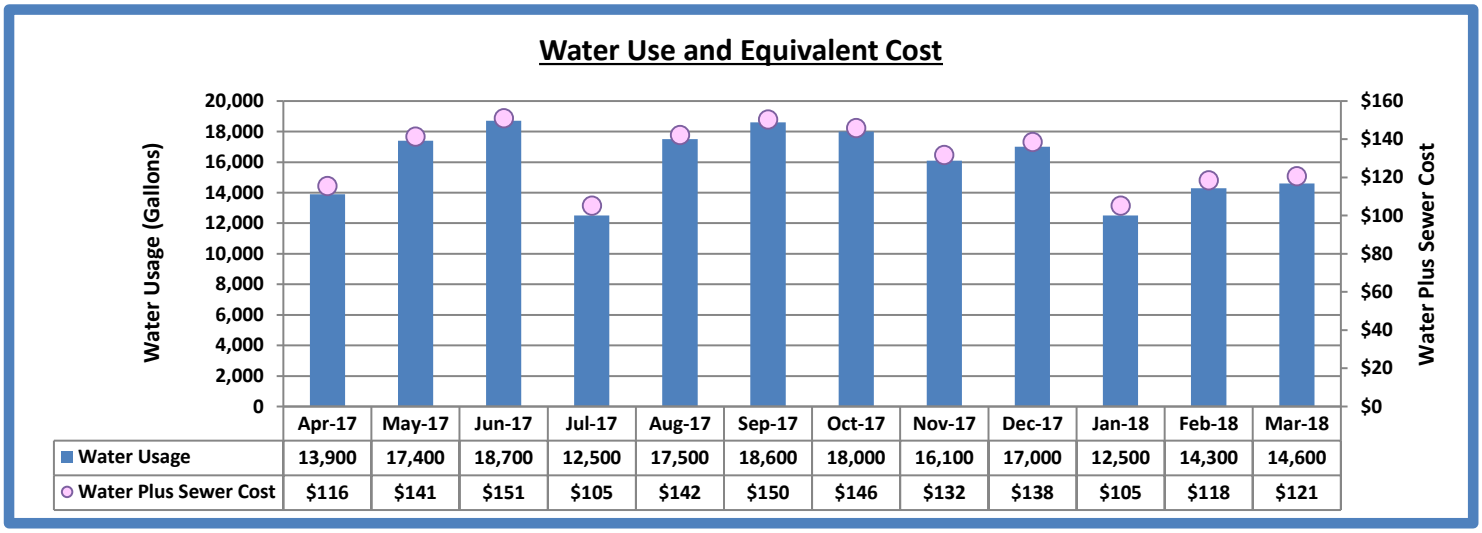
Doors and windows are relatively new and in good condition. No recommendations for this area.

Water Use Recommendations

Water Usage and Cost

Water usage was provided in 100 gallons units and converted to gallons for the figure below.

Hendersonville does not charge itself for water and sewer. This report calculates an effective cost based on $.0074 per gallon to illustrate the benefit of water savings.



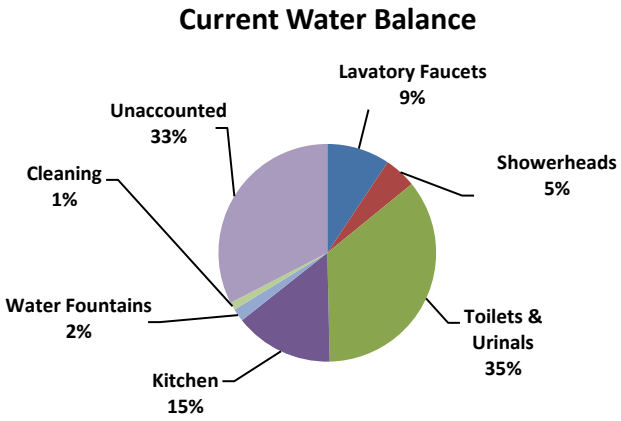
	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18
Water Usage	13,900	17,400	18,700	12,500	17,500	18,600	18,000	16,100	17,000	12,500	14,300	14,600
Water Plus Sewer Cost	$116	$141	$151	$105	$142	$150	$146	$132	$138	$105	$118	$121

Water Use Analysis

The water use at City Hall is dominated by bathrooms used by staff and visitors. Estimates for water use were made for each of the categories shown in the following table and pie chart. Conservative estimates were made for bathroom use, however, these still left a third of the water use unaccounted for. If the bathroom use is actually higher than the estimates, then projected water saving will be proportionately larger.

Estimated Current and Future Water Use

Category	Current Use (Gallons/Year)	Future Use (Gallons/Year)
Lavatory Faucets	17,870	4,964
Showerheads	9,125	7,300
Toilets & Urinals	67,890	32,138
Kitchen	28,080	23,400
Laundry	0	0
HVAC	0	0
Water Fountains	3,650	3,650
Irrigation	0	0
Cleaning	2,196	2,196
Unaccounted	62,289	62,289
TOTAL	191,100	135,937



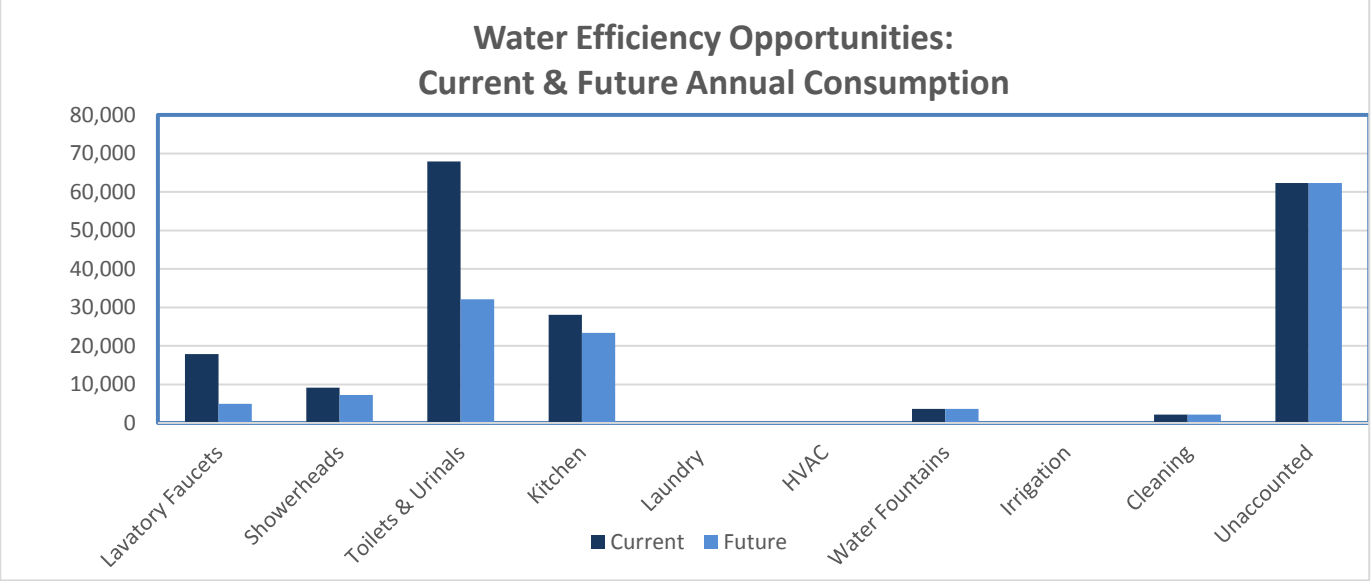
The facilities at City Hall have already reached a good level of water efficiency. There is, however, room for improvement.

Upgrades to faucets by changing the aerators would have a payback of only a few months.

Converting urinals to extremely low flow would have a payback of several years. Upgrading toilets from 1.6 to 1.28 gallons per flush is a modest reduction with a long payback. Incorporating a toilet change as part of a remodeling project should be considered.

There are only two showerheads, but the estimated flowrate is greater than needed. Installing 2.0 gpm shower heads will have an impact on reducing water use and the payback is nearly immediate.

The water savings illustrated in the chart look modest; however, the estimated annual reduction is approximately 55,000 gallons per year. The cost saving would be over $400 if the city charged itself for water. Details of these recommendations are described below.



Summary of Water Use Recommendations

Water is provided by the Hendersonville Sanitary Water & Sewer District. Areas of potential water savings were identified and listed in the following table. The City Hall is already doing a good job with water conservation and the projected savings in consumption is documented. Specifics of each individual recommendation is described in the Details Section below.

Summary of Recommendation Details

Upgrade Option	Water, Sewer, Energy Savings per Year						Upgrade Cost and Payback				
Fixture	Current Use (gallons/yr)	Percent Saved	Water Savings (gallons)	W/S Cost Savings	Energy Cost Savings	Total Cost Savings	No. of Units	Equip. Cost per Unit	Labor Cost per Unit	Total Cost	Payback yrs
0.5 Lav Faucets	17,870	72%	12,906	$ 96	$ 55	$ 151	19	$ 5	$ -	$ 95	0.6
2.0 Showerheads	9,125	20%	1,825	$ 14	$ 8	$ 21	2	$ 10	$ -	$ 20	0.9
1.28 HE Toilets	35,040	20%	7,008	$ 52	$ -	$ 52	17	$ 350	$ 100	$ 7,650	147.3
Urinals	32,850	88%	28,744	$ 213	$ -	$ 213	6	$ 350	$ 100	$ 2,700	12.7
aerator	28,080	17%	4,680	$ 35	$ -	$ 35	1	$ 5	$ -	$ 5	0.1
Total	122,965	45%	55,163	$ 409	$ 63	$ 472	0	$ 720	$ 200	$ 10,470	

Discussion of Water Efficiency Recommendations

Change the aerators on bathroom faucets from 1.5 gpm to 0.5 gpm. Cost should be less than $5 each with almost immediate payback.

Upgrade Option		Water, Sewer, Energy Savings per Year					Upgrade Cost and Payback				
Fixture	Current Use (gallons/yr)	% saved	Water Savings (gallons)	Water & Sewer Cost Savings	Energy Cost Savings	Total Cost Savings	No. of Units	Equip. Cost per Unit	Labor Cost per Unit	Total Cost	Payback yrs
0.5 Lav Faucets	17,870	72%	12,906	$96	$55	$151	19	$5	$0	$95	0.6

Install 2.0 gpm showerheads. New 2.0 shower heads can be purchased for as low as $10 each. Niagara Power Shower Heads are a good example at $10 each.

Upgrade Option		Water, Sewer, Energy Savings per Year					Upgrade Cost and Payback				
Fixture	Current Use (gallons/yr)	% saved	Water Savings (gallons)	Water & Sewer Cost Savings	Energy Cost Savings	Total Cost Savings	No. of Units	Equip. Cost per Unit	Labor Cost per Unit	Total Cost	Payback yrs
2.0 Showerheads	9,125	20%	1,825	$14	$8	$21	2	$10	$0	$20	0.9

The current toilets are 1.6 gallons per flush (code standard back in 1995); the codes for 1.6 gpf have changed since 1995. Savings could be obtained by upgrading to High Efficiency Toilets (HET) using 1.28 gallons per flush. The estimated cost saving does not warrant an immediate investment; however, the upgrade could be incorporated into the future remodeling.

Upgrade Option		Water, Sewer, Energy Savings per Year					Upgrade Cost and Payback				
Fixture	Current Use (gallons/yr)	% saved	Water Savings (gallons)	Water & Sewer Cost Savings	Energy Cost Savings	Total Cost Savings	No. of Units	Equip. Cost per Unit	Labor Cost per Unit	Total Cost	Payback yrs
1.28 HE Toilets	35,040	20%	7,008	$52	$0	$52	17	$350	$100	$7,650	147.3

Best in class water-saving urinals use only 1/8 the amount of water used by the current urinals (1 gpf). Upgrading the urinals is projected to save 28,000 gallons of water per year.

Upgrade Option		Water, Sewer, Energy Savings per Year					Upgrade Cost and Payback				
Fixture	Current Use (gallons/yr)	% saved	Water Savings (gallons)	Water & Sewer Cost Savings	Energy Cost Savings	Total Cost Savings	No. of Units	Equip. Cost per Unit	Labor Cost per Unit	Total Cost	Payback yrs
Urinals	32,850	88%	28,744	$213	$0	$213	6	$350	$100	$2,700	12.7

The kitchen sink water flow should be restricted to 1.5 gpm with and aerator. If the current flow is 1.8 gpm and the faucest is used for 60 minutes per day, then over 4,600 gallons could be saved with a simple change.

Upgrade Option		Water, Sewer, Energy Savings per Year					Upgrade Cost and Payback				
Fixture	Current Use (gallons/yr)	% saved	Water Savings (gallons)	Water & Sewer Cost Savings	Energy Cost Savings	Total Cost Savings	No. of Units	Equip. Cost per Unit	Labor Cost per Unit	Total Cost	Payback yrs
Kitchen sink aerator	28,080	17%	4,680	$35	$0	$35	1	$5	$0	$5	0.1

Appendices

A. Facility Statistics

Square Footage	Year Constructed	Hours Occupied per Week	# of Occupants
30,895	1928	Est. 20 staff 50 hr/wk and average of 8 police 168 hr/wk	

B. Utility History

Mo / Yr	Elect-All Usage KWH	Electric Cost	Nat Gas Usage Therms	Nat Gas Cost	Oil Usage Gallons	Oil Cost	Propane Usage Gallons	Propane Cost	Water Usage Gallons	Water / Sewage Cost *
17-Apr	41,833	$2,762	$1,083	$885	0	$0	0	$0	13,900	$116
17-May	43,413	$2,873	$787	$657	0	$0	0	$0	17,400	$141
17-Jun	42,449	$2,866	$93	$96	0	$0	0	$0	18,700	$151
17-Jul	44,498	$3,812	$77	$83	0	$0	0	$0	12,500	$105
17-Aug	48,218	$3,957	$80	$85	0	$0	0	$0	17,500	$142
17-Sep	47,369	$4,076	$534	$461	0	$0	0	$0	18,600	$150
17-Oct	42,889	$3,790	$765	$652	0	$0	0	$0	18,000	$146
17-Nov	41,808	$2,994	$1,036	$848	0	$0	0	$0	16,100	$132
17-Dec	32,061	$2,316	$1,054	$856	0	$0	0	$0	17,000	$138
18-Jan	29,374	$2,047	$1,671	$1,297	0	$0	0	$0	12,500	$105
18-Feb	36,124	$2,380	$1,069	$843	0	$0	0	$0	14,300	$118
18-Mar	30,824	$2,285	$1,064	$861	0	$0	0	$0	14,600	$121
Total	**480,860**	**$36,159**	**9,313**	**$7,625**	**0**	**$0**	**0**	**$0**	**191,100**	**$1,566**

* The amount Water / Sewer would cost if City of Hendersonville billed itself for this service.

Utility	Utility Totals		Conversion to BTU Equivalents			Total Units	
Electricity	480,860	X	3,413	Btu/kWh	=	1641	Million Btu's
Natural Gas	9,313	X	100,000	Btu/Therm	=	931	Million Btu's

Total Energy Use	=	2572.475 MMBtu's
Total Sq. Ft.	=	30895.000 FT^2
Total Energy Index	=	83.265 kBtu's /sq ft
TOTAL COST INDEX	=	**1.417 $ / SQ FT**

C. Resources and Fact Sheets

Financial Incentives for Energy Projects

Duke Energy Business Incentives - Duke Progress Energy's Smart Saver Program and Small Business Energy Saver Program offer incentives for many energy efficiency upgrades, including lighting upgrades. These incentives will reduce investment cost and shorten payback periods for the upgrades. For more information, please visit:

https://www.duke-energy.com/business/savings

Waste Reduction Partners Technical Publications

Waste Reduction Partners has created a number of technical publications to help you pursue your utility cost-saving and environmental goals. Click on the link below to open the document.

http://wastereductionpartners.org/resources/fact-sheets-2

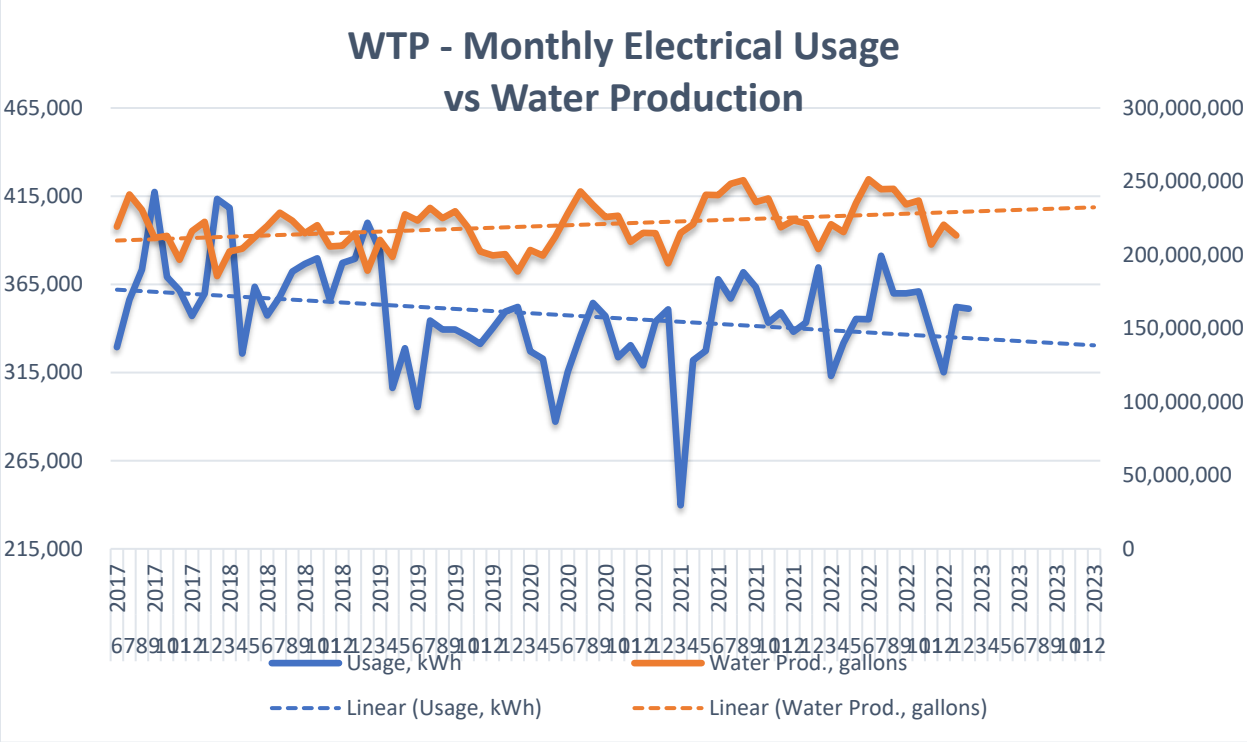
D. Follow-up Evaluation

Waste Reduction Partners provides energy, solid waste, water, and pollution prevention assessments to institutional and business entities throughout North Carolina. These assessments are confidential, non-regulatory, and provided at no or reduced cost to the client. A follow-up contact will be made with clients 6-12 months after this assessment report has been delivered to discuss the value of the assessment. The purpose of the follow-up is to evaluate the effectiveness of our reports and consultation and to determine if report recommendations were found to be worthy of implementation. You are encouraged to take the few minutes required to complete the follow-up in order to help Waste Reduction Partners continually improve its services.

Sustainability Efforts

- Inline Hydrokinetic Energy Recovery Turbine Generators – We have investigated this possibility at our water treatment facility a couple of different times and have determined that we do not have a large enough raw water pipeline to make this project affordable and cost-effective. Minimum pipe diameter is 24-inches while our pipe is only 16-inches in diameter.

- Replace High-Service Pumps and Motors with High-Efficiency Motors with Variable Frequency Drives (VFDs) at Water Treatment Facility – This project was completed in May 2019 at a cost of $2,207,623 which included engineering, equipment purchase and contractor for installation. We have reduced our monthly power consumption by 8% or 377,145 kWh annually, on average, while our water production has increased 2.49% or 64,094,000 gallons annually, on average.



- Replace Existing Ultraviolent (UV) Disinfection System at Wastewater Treatment Facility with High-Efficiency UV System – Project is currently in the construction phase. The estimated ROI on the equipment cost is ~7-years and it is forecasted to reduce electrical costs by up to 40%. Total cost for this project, including engineering, equipment purchase, pipe purchase and contractor for installation is $3,759,219 while the cost for the equipment-only is $565,000. The $3.759M cost includes construction of a new channel, new piping to feed both channels and a new effluent metering system.

- Replace Existing 250-hp Centrifugal Blowers (3) with New Turbo Blowers with Variable Frequency Drives (VFDs) – This project is described in our 2022 WWTP Master Plan prepared by McKim & Creed. The 3-existing blowers are one-speed and can not be controlled with VFDs. So, when we only need 1.5-blowers we turn on 2-blowers thus using more energy than is truly necessary. With these new blowers, we will have the ability to control the output of each blower thus reducing our overall energy consumption.

- WWTF Biosolids Thermal Drying System – Currently, we are dewatering our biosolids produced at our WWTF to about 18% solids, or ~82% water, and then transporting this material to Haywood County to a privately owned and maintained MSD landfill. We also dewater our WTF residuals at the WTF and transport them to the WWTF with the same final destination. Over the past couple of years, the cost to do this has almost doubled in cost for both treatment facilities. With the new biosolids thermal drying system, we will have the ability to increase the solids content from ~18% to ~85 to 90% thus reducing the amount of water that we are paying to landfill. The second part of this project is to generate a much more sustainable final product that no longer needs to go to a landfill but can instead be used as a soil amendment in both residential and commercial applications. This project is slated to begin engineering design and permitting in FY2024 with construction beginning some time in FY2025 at a cost of ~$12,500,000.

- WTF Residual Management – The third part of this solids management effort is the residuals from the water treatment process. These residuals will be dewatered on-site by a contractor and then disposed of as a soil amendment rather than going to a landfill, resulting in a much more environmentally sustainable process. For this project, we will need to construct a residuals storage facility on the WTP property in Mills River and then select a contractor to dewater, store and dispose of this material. This project is slated to begin engineering design and permitting in FY2023 with construction beginning some time in FY2024 at a cost of ~$1,500,000.

- Advanced Metering Infrastructure (AMI) – In April 2012, the City contracted with Energy Systems Group (ESG) to design and have constructed this new metering system across the City's water system. This project included the replacement of ~26,000 older mechanical meters with meters with much greater accuracy equipped with two-way communications required to transmit meter reading data to 13-towers placed in strategic locations across the City's water system. This allows City staff to read meters daily, if necessary, and eliminated the need for manual meter reading on a monthly basis with 4-meter readers. This greatly reduced the City's carbon footprint and provided a way for staff and our customers to identify demand-side leaks before they became a problem. This tool allows the City to reduce the unnecessary loss of a valuable resource…..water. The cost for this project was ~$11,700,000 and was financed over a 15-year period.

- AquaHawk Alerting – This is an app that our customers can place on their phone or computer and can take their water usage, either by cost or volume of usage. This allows our customers to set thresholds for their usage and will alert them when these thresholds are exceeded or when water usage is continuous, thus signaling to the customer that they may have a leak. City staff can also monitor this program for demand-side leaks and can notify our customers of these potential leaks on a daily basis. This service is provided to our customers at no charge.

- Water Loss Reduction Program – Both the AMI system and AquaHawk Alerting are active components of this program. In addition to these, the City Council and City management approved our department to create a new position, referred to as a leak detection technician, in 2014 and was dedicated to monitoring our vast water distribution system for water loss. Along with this individual position, we were afforded the opportunity to hire and equip a crew focused on repairing water leaks identified by our technician. This has allowed us to greatly decrease our water losses, or non-revenue water (NRW), over the past 9 years.

- Inflow and Infiltration Reduction Program – Inflow is generally defined as either storm water or surface water entering the sewer collection system while infiltration is groundwater infiltrating the sewer collection pipe network through cracks and voids in the pipes. Like the water loss reduction program, we began an inflow and infiltration reduction program in 2014 with the hiring of an inflow infiltration technician. The crew referenced above was also focused on repairing issues in the sewer collection identified by this technician. With this program, we have seen a noticeable reduction in the flows entering our wastewater treatment facility on a daily basis over the past 9 years.

- Long John Mountain Water System Improvements – The City provides water to customers along Long John Mountain off of U.S. Highway 64W (Brevard Rd.) and NC Highway 191 (Haywood Rd.). The water system in these areas was installed mostly by developers over the last several decades. Because of the piecemeal nature of this water system development, there are ~12 pumping stations and 2 tanks. The construction of a new booster pumping station and water storage tank on Long John Mountain that would be at an elevation that will result in the elimination of at 10 of the 12 aforementioned pump stations and both existing water tanks. The project would boost water pressure and available fire flow for many area customers. The abandonment of the near dozen pump stations would also result in a significant reduction in energy consumption and operation and maintenance burdens.

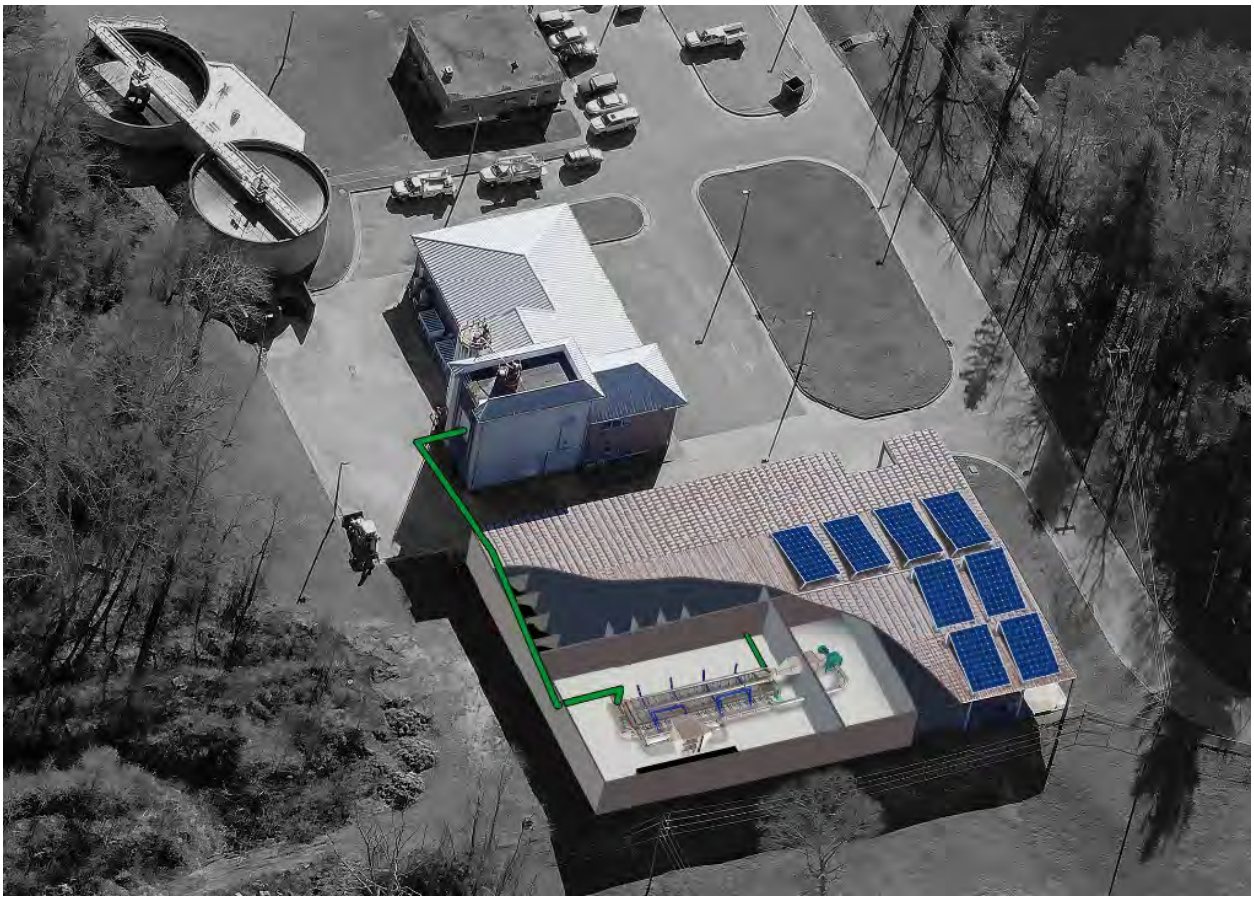
- 2016 Multi-Area Streambank Restoration – Stream restoration project where the integrity of existing sanitary sewer infrastructure was threatened by nearby streams at 12-different locations. These streams, impacted by development and redevelopment over the years have significant bank erosion and degradation of riparian zones, are encroaching on sewer pipes and/or manholes. The goal of this project was to protect the existing sanitary sewer infrastructure through a combination of live plantings and bioengineering and enhance the overall health of the stream. The total cost for this project was ~$2,900,000.

- 2021 Streambank Restoration – As with the previous streambank restoration project, the integrity of existing sanitary sewer infrastructure has been threatened by nearby streams at several different locations. These streams, also impacted by development and redevelopment over the years have significant bank erosion and degradation of riparian zones, are encroaching on sewer pipes and/or manholes. The goal of this project, like the other, is to protect the existing sanitary sewer infrastructure through a combination of live plantings and bioengineering and enhance the overall health of the stream. The estimated cost of this project is currently ~$600,000.

- Elimination of Pump Stations – We have a standing objective to eliminate sewer pump stations with gravity sewer (Jackson Park gravity sewer eliminated our largest sewer pumping station in 2014) and eliminate smaller water pump stations with single, larger stations pumping to storage tanks at higher elevations (i.e., Long John Mountain Water Improvements project). Over the past 18 years, we have eliminated 8 sewer pump stations and 6 water pump stations. As previously mentioned, the Long John Mountain project will eliminate 9 hydro pump stations, 2 booster pump stations and 2 water storage tanks. All of these stations and tanks will be replaced with one more efficient larger pump station and one storage tank at a higher elevation.

- Solar Power Generating Panels – We have explored the use of these panels on several of our facilities and have always determined those not to be cost effective. We are considering the use of these panels with our thermal

biosolids drying system project to be placed on top of the building used to store the finished project. We are also investigating the use of these on our new residuals storage building at the water treatment plant, as well.



Rendering of Biosolids Drying Building