ENERGY & WATER ASSESSMENT REPORT

Southface

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ASSESSMENT REPORT

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About Southface

Southface promotes sustainable homes, workplaces and communities through education, research, advocacy and technical assistance.

Our Vision: A regenerative economy, responsible resource use and social equity through a healthy built environment for all.

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ASSESSMENT REPORT

Montevallo City Hall and PD

6/28/2021

541 Main Street
Montevallo, AL 35115

Site Details

- Building Type: Public Services - Police Station
- Square Footage: 8,000 sq ft
- Built: 2016

Energy & Water Benchmarks

- $17,829 - Annual Utility Cost
- 85% Cost - Electricity
- 11% Cost - Natural Gas
- 4% Cost - Water (estimated)

Project Contacts

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Executive Summary

The Montevallo City Hall and Police Department is a public services facility with a gross floor area of 8,000 square feet. The building consists of 3 sections: City Hall on the left, lobby and Council Chamber in the center, and the Police Department on the right. In both the City Hall and Police Department there are offices, break rooms, hallways, and restrooms. Southface estimates that if all efficiency projects are undertaken, energy savings of up to 52% and water savings of up to 37% can be achieved.

Project Summary Table

#	Efficiency Measure	Annual Cost Savings	Budgetary Project Cost Estimate	Simple Payback (Years)	Estimated Annual Electricity Savings (kWh)	Estimated Annual Natural Gas Savings (therms)	Estimated Annual Water Savings (kGal)
1	LED Retrofit	$1,833	$10,995	6.0	11,746		
2	HPWH	$740	$2,400	3.2	4,741		
3	HVAC Upgrade to 20 SEER (ROB)	$1,408	$24,000	17.0	9,022		
4	Low Flow Plumbing Fixtures	$241	$620	2.6			30
5	Solar PV (30kW)	$3,888	$75,000	19.3	40,698		
6	Maintenance: Fix gas leak (existed in 2018 and 2019)	$254		0.0		177	
Total		**$8,364**	**$113,015**	**13.5**	**66,207**	**177**	**30**

**These estimated costs are for a Replace on Burnout (ROB) scenario, so they are the incremental cost between replacing the HVAC units with identical models and replacing them with the higher efficiency option.

Energy & Water Profile

Consumption Profile

The City Hall/PD spends $15,239 annually for electricity, $1,935 for natural gas, and an estimated $655 for water (based on fixture specs, occupancy schedule, and average local water rates). The average cost of the utilities is $0.156 per kWh for electricity, $1.434 per therm, and $8 per thousand gallons of water.

Utility	Consumption Annual Use	Annual Cost	Cost Intensity ($/Sq-Ft)
Electricity	97,640 kWh	$15,239	$1.9/Sq-Ft
Natural Gas	1,349 therms	$1,935	$0.2/Sq-Ft
Water	82 kGal*	$655*	$0.1/Sq-Ft
Total Utilities		**$17,829**	**$2.2/Sq-Ft**

*These were estimated from the building's occupancy schedule, equipment and fixture specs, and local average utility rates.

Benchmarking

This building's energy performance was benchmarked using the ENERGY STAR Portfolio Manager tool comparisons. Benchmarking is the process of evaluating the energy performance of a facility relative to key indicators, including the performance of peers and the historic performance of one's own facility. Portfolio Manager provides a relevant source of comparative energy performance metrics by normalizing energy use of similar facilities by space-type, floor area, operating hours, climate, and other space attributes.

Utility	Annual Use	Current EUI	Estimated Post-Retrofit EUI	Estimated Post-Retrofit Savings %
Electricity	333,148 kBTU	59 kBTU/Sq-Ft	30 kBTU/Sq-Ft	52%
Natural Gas	134,919 kBTU			
Water	82 kGal	10 Gal/Sq-Ft	6 Gal/Sq-Ft	37%

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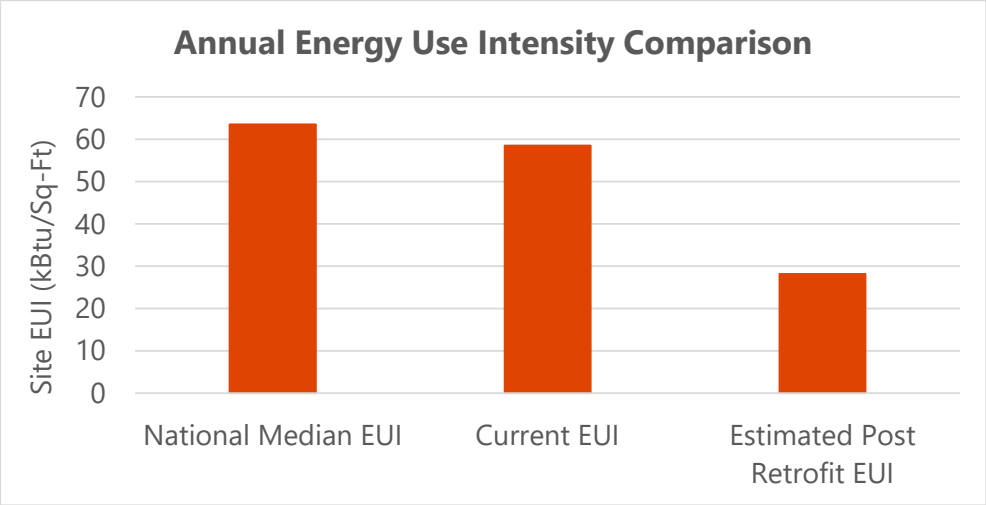
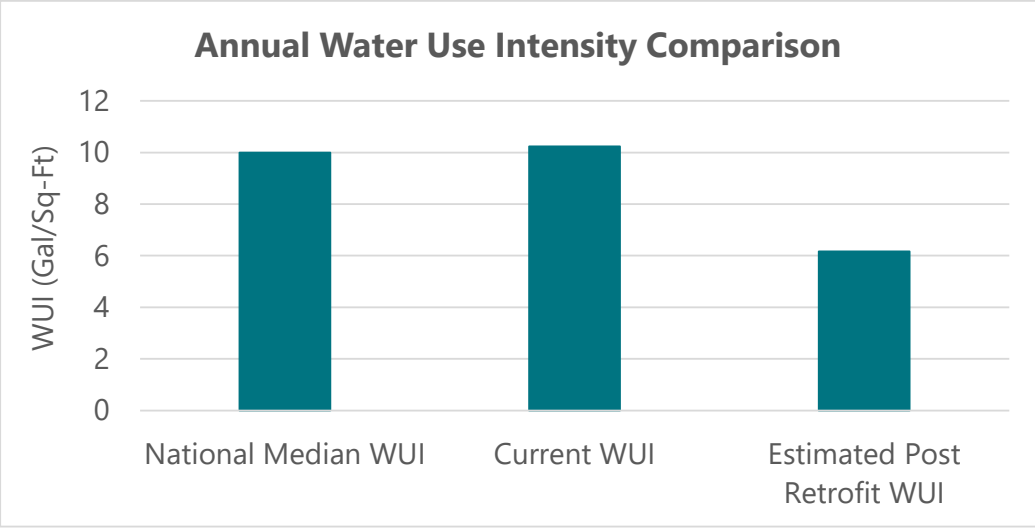
Energy Use Intensity (EUI) is a metric used to compare the annual energy usage of buildings, including all energy types consumed within the building, divided by gross floor area. The building has a slightly lower site EUI than the national median for Police Stations. The following chart shows how it compares to the median, and an estimate of the post-retrofit energy use (52% savings).

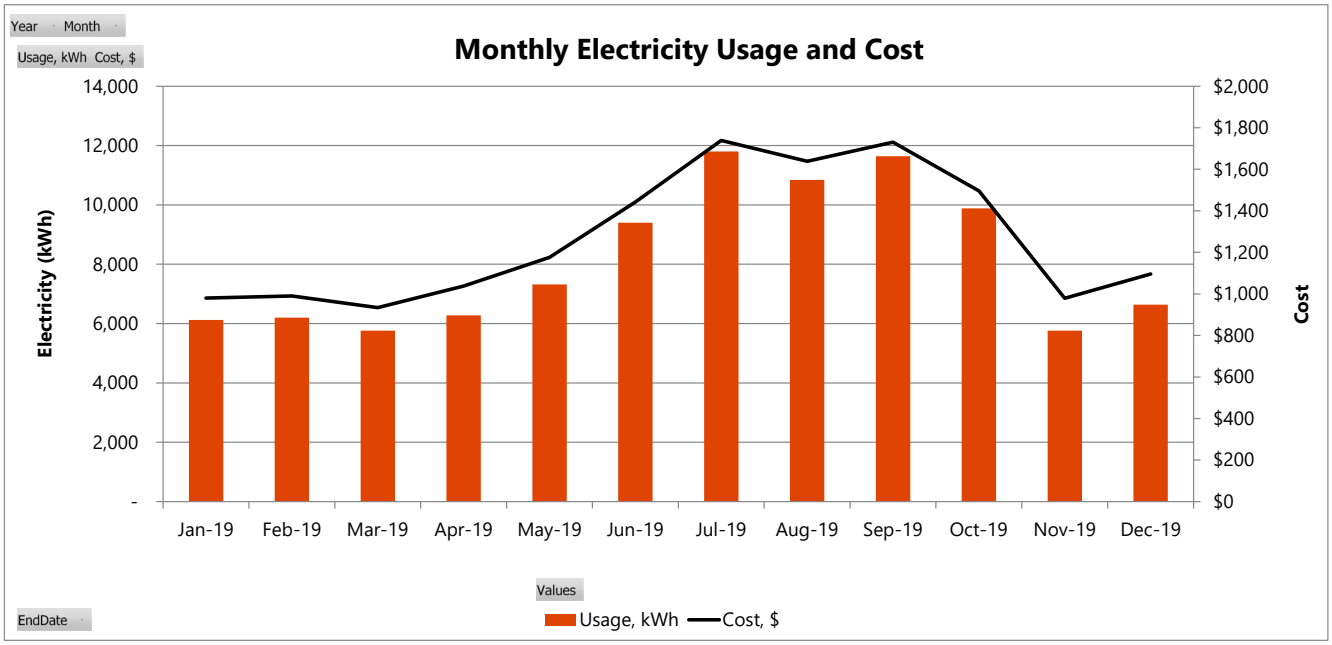


Water Use Intensity (WUI) is a metric used to compare the annual water usage of buildings divided by gross floor area. The following chart shows how your building compares to the national median WUI for similar building types, as well as an estimate of post-retrofit usage (37% savings). The water usage was estimated from the building's occupancy schedule and plumbing fixture specs.

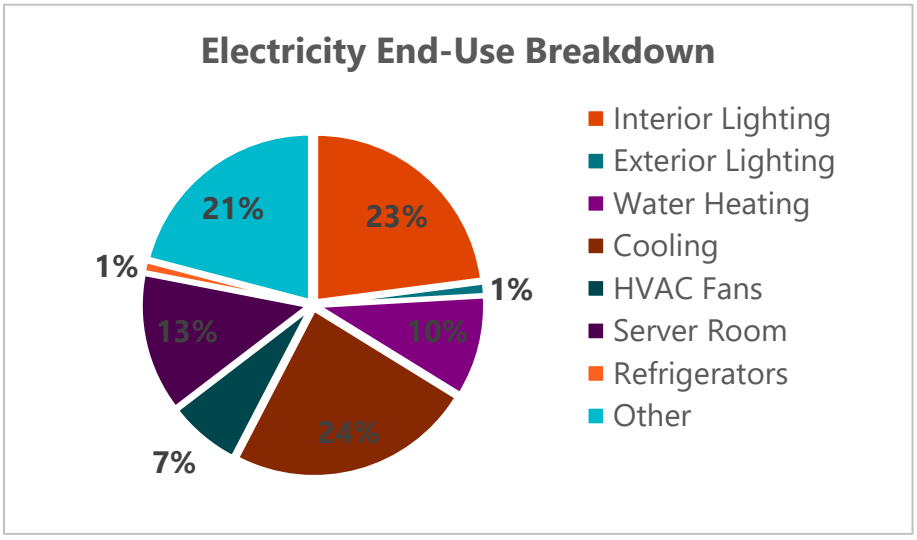


Electricity Profile and Breakout by End Usage

The pre-COVID annual electricity profile for the building is displayed in the below figure. The monthly electricity use is highest in summer and lowest in winter, which is typical for buildings with electric A/C and gas heat.

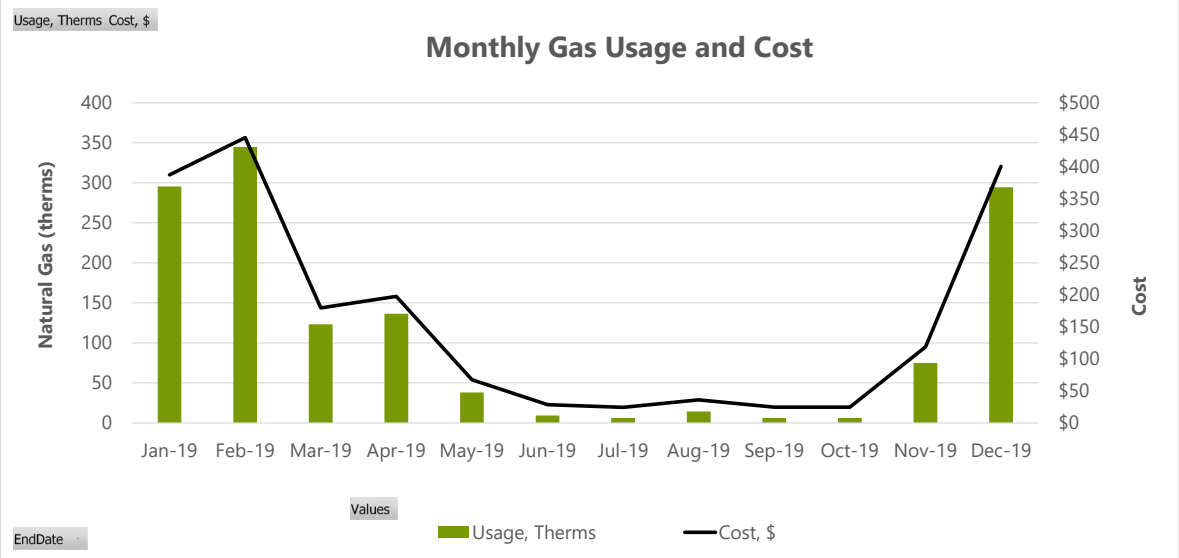


The electricity is broken out by end-use in the figure below. This is an estimate and was developed from the bottom-up using counts and specs from the lighting and HVAC surveys as well as top-down using the billing data. “Other” includes end uses such as plug loads and other ancillary equipment.

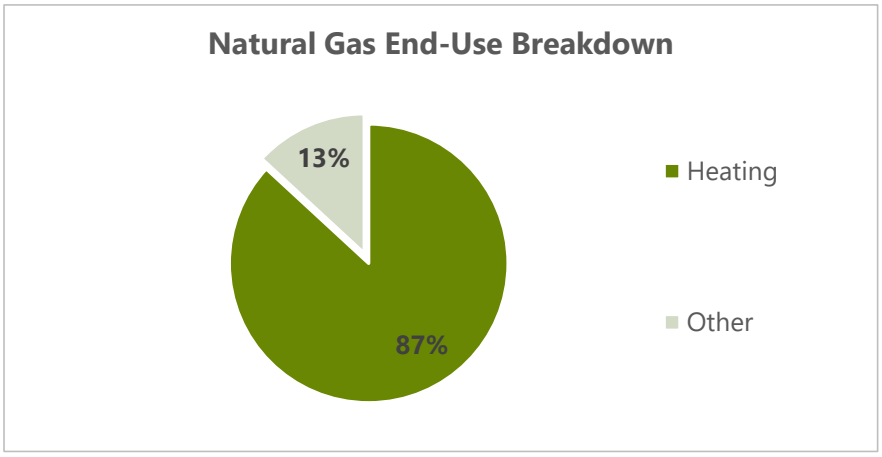


Natural Gas Profile and Breakdown by End Usage

The annual natural gas profile for the building is displayed in the below figure. The monthly gas use is much higher in the winter than the summer which is typical for buildings with gas heat. The baseline gas consumption during warm months is usually due to a gas water heater, however the water heater in the facility is electric. My guess is there is a small leak in one of the exterior gas pipes that supply the RTUs, probably at a joint.

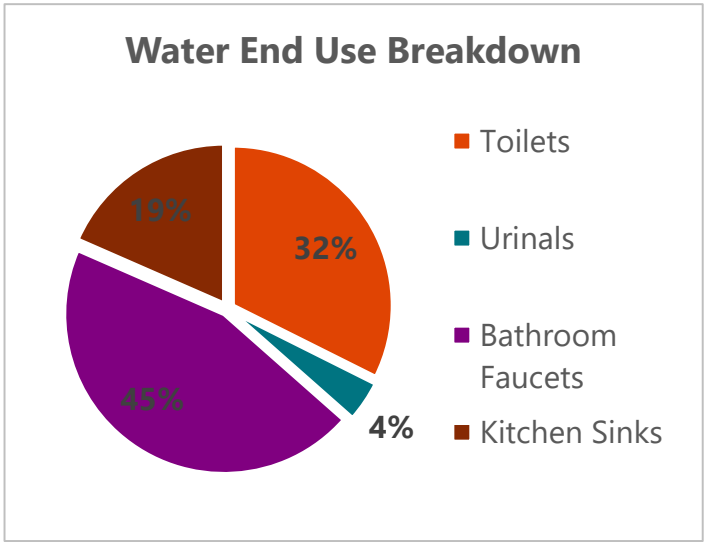


The gas is broken out by end-use in the figure below. This is an estimate and was developed from the bottom-up using counts and specs from the water heaters and HVAC surveys as well as top-down using the billing data. “Other” normally includes end uses such as cooking and other ancillary gas equipment, however none exists. Checking for a potential leak is covered in project #6.



Water Breakdown by End Usage

The water is broken out by end-use in the figure below. This is an estimate and was developed from the bottom-up using counts and specs from the water fixture survey.



Project Recommendations

For any questions regarding the recommended projects, please contact your assigned engineer.

1. LED lighting Retrofit

Convert existing fixtures to LED lighting. Occupancy/vacancy controls already exist in appropriate spaces. The efficiency, long equipment life, and controllability coupled with the absence of mercury reduce the overall environmental impact of artificial lighting. LED would also provide a more consistent color temperature and superior quality. Note that Southface Institute recommends either full fixture replacement or retrofit kits with external drivers over “plug and play” LED tubes. Reach out to your project engineer if you have questions on this. Additional detail can be seen in Appendix A.

2. Heat Pump Water Heater

Southface recommends replacing the water heater with a heat pump water heater (HPWH) which is more than two times as efficient as a standard electric water heater.

3. HVAC Upgrade to 20 SEER (ROB around 2035)

When it is time to replace the existing packaged A/C and furnace roof top units (RTUs), we recommend upgrading to 20 SEER units rather than the current minimum efficiency of 14 SEER. The cost associated with this project is the incremental difference between a standard unit and a higher efficiency one. It is also recommended to upgrade to demand controlled ventilation for the units serving the lobby and the Council Chambers.

4. Low Flow Plumbing Fixtures

Existing plumbing fixtures can be replaced with WaterSense certified low-flow plumbing fixtures. This will help reduce usage in multiple ways, as the fixtures have lower GPM and GPF, and the installation of new fixtures will resolve any leaks that may have gone unnoticed over time. WaterSense specs are:
Toilet: 1.28GPF
Urinal: 0.5 GPF
Faucet: 0.5 GPM
Shower: 2.0 GPM

Additional detail can be seen in Appendix B.

5. Solar PV (30kW)

Installation of a photovoltaic (solar panel) system will reduce utility costs immediately. The PV system sizing and production was estimated using an NREL-developed tool called PVWatts. Cost savings estimates assumed a buy-back rate equal to $0.035/kWh and 50% of production buy-back.

Speaking with a local or regional solar contractor is recommended to determine the specific procedures and buyback rates associated with installing rooftop solar in Alabama Power's territory. That will directly impact project payback time. Additional detail can be seen in Appendix C.

6. Maintenance: Fix Gas Leak

The gas bill indicates consistent summer usage in both 2019 and 2020, which means there was likely a slow gas leak since no other gas equipment exists in the building. It may have existed at one of the joints connecting the gas lines to the RTUs, so may have been repaired when the RTUs were recently replaced. To see if this is the case, look at the most recent gas bills for May and June. If there is still usage, then contact the gas company who usually will come perform a free gas leak detection assessment.

Existing Building Conditions

Building Envelope

The building envelope is in overall very good condition, with double pane windows, brick exterior, and a flat TPO “cool” roof. Air sealing appears to be better than average and the insulation is to code. There are no issues at this time.

Lighting

Lighting is primarily T8 fluorescent tubes and pin based CFLs. The building would benefit greatly from the superior efficiency and quality of LED lighting (project #1). The long hours of use in the police department would make the project pay back quite rapidly, especially if targeting the highest use areas only for retrofit. Payback of individual areas can be seen in Appendix A.

Plumbing and Potable Water Use

All faucets and one toilet are standard efficiency fixtures, but the urinal and remaining toilets all meet WaterSense specifications. Retrofitting the existing faucets with low-flow (down to 0.5 GPM) aerators will save lots of water and have a very rapid payback. Doing that alongside a replacement or retrofit of the standard toilet can keep the overall payback short.

Domestic Hot Water

The current water heater is a 30 gallon Rheem electric resistance unit from 2016. The expected useful life of electric water heaters is around 13 years, so it could be replaced on burnout around 2029. A standard replacement is around $1000, so upgrading to a HPWH would be about $1400 more, resulting in a 1.9 year payback for the ROB scenario.

Health and Safety

The main health and safety issue was inferred from the gas bills and is addressed by project #6. An additional health issue, namely excessive humidity, has already been addressed by replacing the old RTUs with units equipped with dehumidifying capability.

Additional Resources

Southface's Alabama Energy Code Field Guide

A helpful resource to see how new buildings should be constructed and how existing buildings measure-up is Southface's Alabama Energy Code Field Guide.

Commercial Code Field Guide:
https://4553qr1wvuj43kndml31ma60-wpengine.netdna-ssl.com/wp-content/uploads/2020/10/Alabama-Commercial-Field-Guide_FINAL-Sept-2020-1.pdf

Residential Code Field Guide:
https://4553qr1wvuj43kndml31ma60-wpengine.netdna-ssl.com/wp-content/uploads/2020/07/FINAL_Alabama_2020-Residential-Field-Guide.pdf

Alabama Power Rebate Program

There are limited rebates available through Alabama Power as well as some general tips. Details on rebate amounts and eligibility can be seen here:

https://www.alabamapower.com/business/save-money-and-energy.html

Appendices

Appendix A: Lighting & Controls Detail

Existing						Proposed			Cost		
Area	Fixture	Qty	Total Watts	Annual Hours	Annual kWh	Fixture Type	Total Watts	Annual kWh	Total Project Cost	Annual Cost Savings	Payback (years)
Lobby	Pin based CFL 26W	10	260	8,760	2,278	LED 4 Pin G24q Base bulb	130	1,139	$300	$178	1.7
Lobby	4ft T5 2 lamp	2	126	8,760	1,104	LED Fixture 30W	60	526	$320	$90	3.5
PD Halls	2 Lamp T8 2x4	9	540	8,760	4,730	LED Retrofit Kit (30-watts; 4ft)	270	2,365	$810	$369	2.2
PD Offices	2 Lamp T8 2x4	20	1,200	3,227	3,872	LED Retrofit Kit (30-watts; 4ft)	600	1,936	$1,800	$302	6.0
PD Reception	2 Lamp T8 2x4	2	120	8,760	1,051	LED Retrofit Kit (30-watts; 4ft)	60	526	$180	$82	2.2
Closets	2 Lamp T8 2x4	8	480	104	50	LED Retrofit Kit (30-watts; 4ft)	240	25	$720	$4	184.8
PD Confer-ence	2 Lamp T8 2x4	6	360	5,824	2,097	LED Retrofit Kit (30-watts; 4ft)	180	1,048	$540	$164	3.3
PD Bathroom	2 Lamp T8 2x4	1	60	1,092	66	LED Retrofit Kit (30-watts; 4ft)	30	33	$90	$5	17.6
Council Cham-ber	Pin based CFL 26W	30	780	416	324	LED 4 Pin G24q Base bulb	390	162	$900	$25	35.5

Appendix A Cont.

Public Hall-ways	2 Lamp T8 2x4	6	360	624	225	LED Retrofit Kit (30-watts; 4ft)	180	112	$540	$18	30.8
Conf. Room	2 Lamp T8 2x4	4	240	416	100	LED Retrofit Kit (30-watts; 4ft)	120	50	$360	$8	46.2
Bathrooms	2 Lamp T8 2x4	4	240	1,092	262	LED Retrofit Kit (30-watts; 4ft)	120	131	$360	$20	17.6
Offices	2 Lamp T8 2x4	22	1,320	3,227	4,260	LED Retrofit Kit (30-watts; 4ft)	660	2,130	$1,980	$332	6.0
Closets	2 Lamp T8 2x4	4	240	104	25	LED Retrofit Kit (30-watts; 4ft)	120	12	$360	$2	184.8
Hallways	2 Lamp T8 2x4	10	600	3,227	1,936	LED Retrofit Kit (30-watts; 4ft)	300	968	$900	$151	6.0
Outside	26W CFL Can	5	130	3,996	519	LED 4 Pin G24q Base bulb	65	260	$150	$41	3.7
Outside	Wallpack 52W CFL	3	156	3,996	623	LED Wallpack with Photocell and Motion Sensor	120	353	$685	$42	16.2

Appendix B: Low Flow Plumbing Project Detail

Existing						Proposed				Savings and Payback		
Area	Fixture Type	Qty	GPF/ GPM	Annual kGal	Annual Cost	Proposed Fixture Type	Annual kGal	Annual Cost	Fixture Cost (Each)	Annual Savings kGal	Annual Cost Savings	Payback (years)
PD Bath	Toilet	1	1.6	7.80	$62	Toilet - 1.28 GPF	6.2	$50	$600	1.6	$12	48.08
PD Bath	Faucet	1	2.2	9.22	$74	Faucet aerator - 0.5 GPM	2.1	$17	$5	7.1	$57	0.09
PD Bath	Urinal	1	0.5	3.38	$27							
PD Break Rm.	Sink	1	2.2	7.55	$60							
Public Baths	Toilet	2	1.28	12.48	$100							
Public Baths	Faucet	2	2.2	18.45	$148	Faucet aerator - 0.5 GPM	4.2	$34	$5	14.3	$114	0.09
City Ball Baths	Toilet	1	1.28	6.24	$50							
City Ball Baths	Faucet	1	2.2	9.22	$74	Faucet aerator- 0.5 GPM	2.1	$17	$5	7.1	$57	0.09
City Ball Break Area	Sink	1	2.2	7.55	$60							

Appendix C: Solar Panel Detail

The PV system sizing and production was estimated using PV Watts. The estimated monthly energy production and footprint can be seen below. The reason for the oddly-shaped footprint, is to avoid shading by the RTUs and to have several rows of panels facing due south. A solar contractor can help to better visualize with panel icons if desired.

System Capacity: 30.0 kWdc (200 m2)

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PVWatts Calculator

NREL

Caution: Photovoltaic system performance predictions calculated by PVWatts® include many inherent assumptions and uncertainties and do not reflect variations between PV technologies nor site-specific characteristics except as represented by PVWatts® inputs. For example, PV modules with better performance are not differentiated within PVWatts® from lesser performing modules. Both NREL and private companies provide more sophisticated PV modeling tools (such as the System Advisor Model at https://sam.nrel.gov) that allow for more precise and complex modeling of PV systems.

The expected range is based on 30 years of actual weather data at the given location and is intended to provide an indication of the variation you might see. For more information, please refer to this NREL report: The Error Report.

Disclaimer: The PVWatts® Model ("Model") is provided by the National Renewable Energy Laboratory ("NREL"), which is operated by the Alliance for Sustainable Energy, LLC ("Alliance") for the U.S. Department Of Energy ("DOE") and may be used for any purpose whatsoever.

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The energy output range is based on analysis of 30 years of historical weather data for nearby , and is intended to provide an indication of the possible interannual variability in generation for a Fixed (open rack) PV system at this location.

RESULTS

40,697 kWh/Year*

System output may range from 38,613 to 41,766 kWh per year near this location.

Month	Solar Radiation (kWh / m² / day)	AC Energy (kWh)	Value ($)
January	3.77	2,658	415
February	4.25	2,662	415
March	5.22	3,580	559
April	6.05	3,852	601
May	6.39	4,118	642
June	6.45	3,939	614
July	6.22	3,952	617
August	6.14	3,865	603
September	5.64	3,490	544
October	5.16	3,404	531
November	4.25	2,857	446
December	3.29	2,321	362
Annual	5.24	40,698	$ 6,349

Location and Station Identification

Requested Location	541 Main Street montevallo al
Weather Data Source	Lat, Lon: 33.09, -86.86 0.7 mi
Latitude	33.09° N
Longitude	86.86° W

PV System Specifications *(Commercial)*

DC System Size	30.0 kW
Module Type	Standard
Array Type	Fixed (roof mount)
Array Tilt	20°
Array Azimuth	180°
System Losses	14.08%
Inverter Efficiency	96%
DC to AC Size Ratio	1.2

Economics

Average Retail Electricity Rate	0.156 $/kWh

Performance Metrics

Capacity Factor	15.5%

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