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 Senior Center

9/23/2021

434 Vine St.
Montevallo, AL 35115

Site Details

- Building Type: Social/Meeting Hall
- Square Footage: 2,100 sq ft
- Built: Unknown

Energy & Water Benchmarks

- $4,594 - Annual Utility Cost
- 73% Cost - Electricity
- 25% Cost - Natural Gas
- 2% Cost - Water (estimated)

Project Contacts

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Senior Technical Project Manager
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Executive Summary

The Montevallo Senior Center is a social/meeting hall with a gross floor area of around 2,100 square feet. The building consists of a large dining/common room, library and computer rooms, a kitchen, a lobby and hallway, and restrooms. Southface estimates that if all energy and water efficiency projects are undertaken, savings of up to 103% energy and 11% water 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)	Health Impact?
1	LED Retrofit and Controls	$449	3,645	8.1	2,057			
2	20 SEER/10 HSPF ASHP (ROB in 2019)	$1,543	**$8,000	5.2	2,417	633		
3	Low Flow Plumbing Fixtures	$16	$2,420	147.8			2.0	
4	Combustion Closet Weather Stripping	$29	$50	1.7	87	6		
5	Tankless Gas Water Heater (ROB in 2019) and Seal Hi/Lo Vents	$90	**$2,000	22.3	87	44		
6	Solar PV (10kW)	$1,658	$30,000	18.1	13,100			
7	Maintenance: Combustion closet insect screen							X
8	Maintenance: Wire OA damper to open correctly							X
9	Maintenance: Clean A/C Condensate Traps							X
Total		**$3,785**	**$46,115**	**12.2**	**17,747**	**684**	**2.0**	

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

Energy & Water Profile

Consumption Profile

The Senior Center spends approximately $3,349 annually for electricity, $1,162 for natural gas, and an estimated $83 for water (based on equipment specs, occupancy schedule, and average local water rates). The average cost of the utilities is $0.218 per kWh for electricity, $1.604 per therm of natural gas, and $8 per thousand gallons of water.

Utility	Consumption Annual Use	Annual Cost	Cost Intensity ($/Sq-Ft)
Electricity	15,352 kWh	$3,349	$1.6/Sq-Ft
Natural Gas	724 therms	$1,162	$0.6/Sq-Ft
Water	*10 kGal	*$83	$0.0/Sq-Ft
Total Utilities		**$4,594**	**$2.2/Sq-Ft**

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

Benchmarking

The Fire Station'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	52,381 kBTU	59 kBTU/Sq-Ft	-2 kBTU/Sq-Ft	103%
Propane	72,436 kBTU			
Water	10 kGal	5 Gal/Sq-Ft	4 Gal/Sq-Ft	20%

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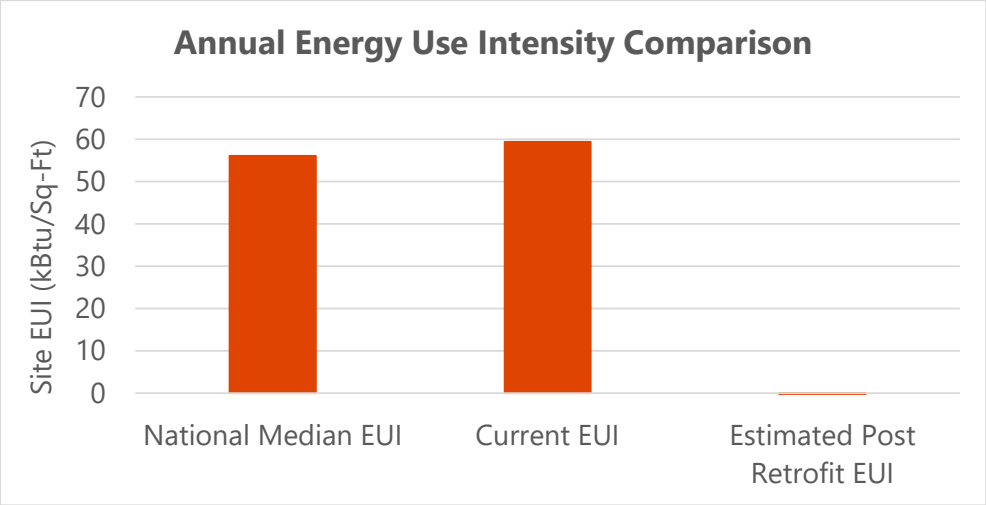
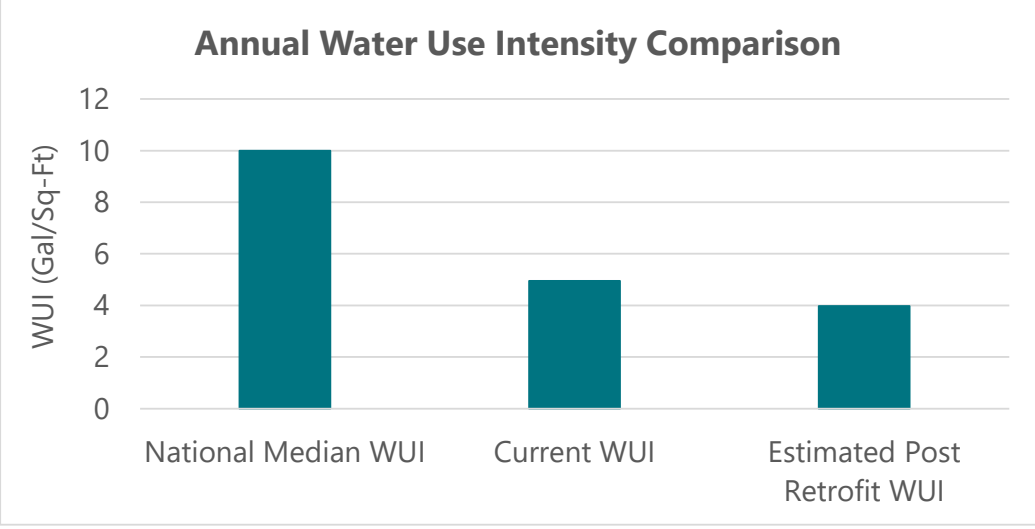
Energy Use Intensity (EUI) is a metric used to compare the annual energy usage of buildings, including all energy types consumed within the building, divided by gross floor area. The Senior Center has a slightly higher site EUI than the national median for social/meeting halls. The following chart shows how it compares to the median, and an estimate of the post-retrofit energy use (103% savings).

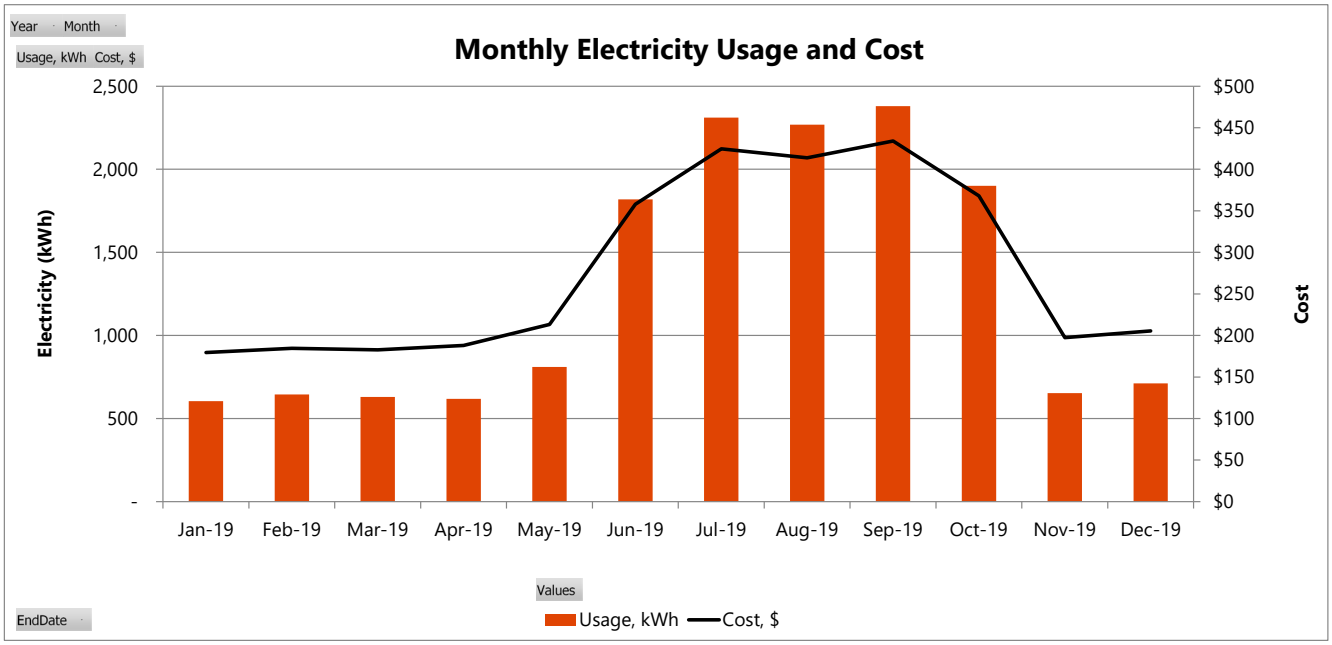


Water Use Intensity (WUI) is a metric used to compare the annual water usage of buildings divided by gross floor area. The following chart shows how the Senior Center compares to the national median WUI for similar building types, as well as an estimate of post-retrofit usage (20% savings). The water usage was estimated from the building's occupancy schedule and plumbing fixture specs.

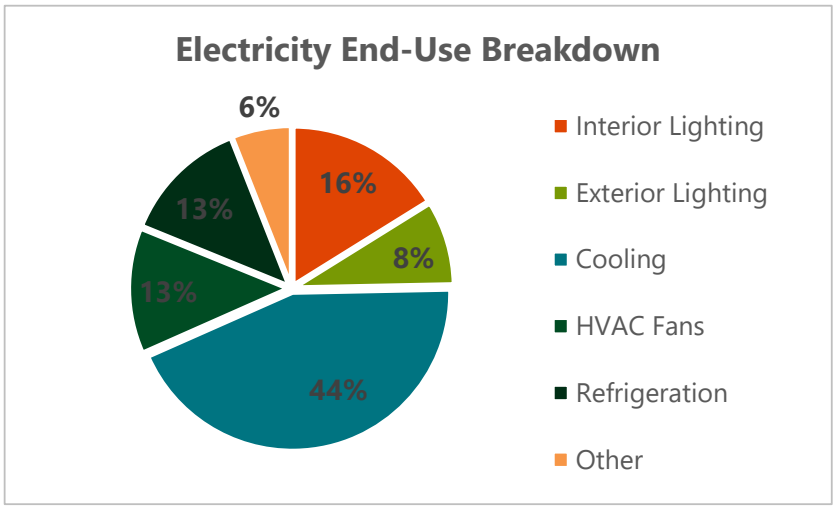


Electricity Profile and Breakdown by End Usage

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

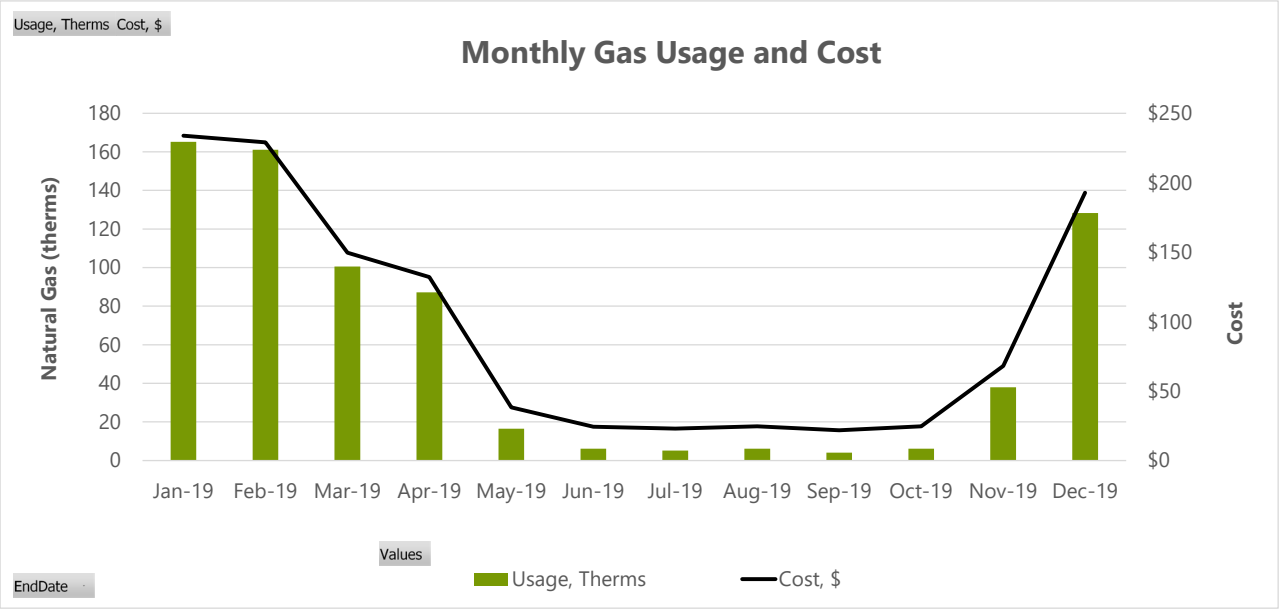


The electricity is broken out by end-use in the figure below. This is an estimate and was developed from the bottom-up using counts and specs from the lighting and HVAC surveys as well as top-down using the billing data. “Other” includes end uses such as plug loads and other ancillary equipment.

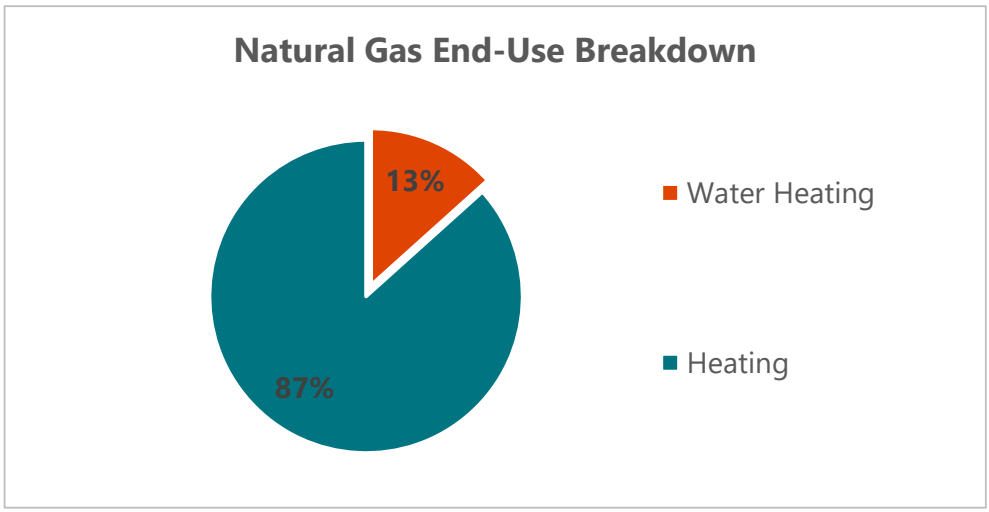


Natural Gas Profile and Breakdown by End Usage

The annual natural gas profile for the building is displayed in the below figure. The monthly gas use is high in the winter and a consistent minimal base load in the summer which is typical for buildings with gas heat and gas water heating equipment.

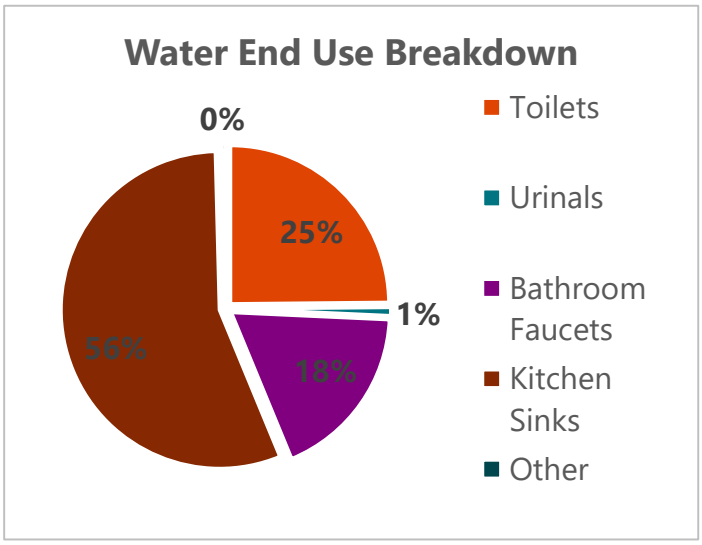


The gas is broken out by end-use in the figure below. 87% of gas usage is for heating and 13% is water heating.



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 as well as occupancy schedule.



Project Recommendations

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

1. LED Retrofit and Controls

Convert existing fixtures to LED lighting. Occupancy/vacancy controls are recommended for 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. 20 SEER/10 HSPF ASHP (ROB around 2019)

We recommend replacing the existing twinned A/C / furnaces with a single air source heat pump (ASHP). One of the existing units is critically low on refrigerant and is frozen. We believe the reason the “Cooling” electricity usage is so high is because 2 units are running, but only 1 is cooling. Both units use R-22 which is now banned, so recharging them would be prohibitively expensive. We recommend upgrading to a 20 SEER or higher unit rather than the current minimum efficiency of 14 SEER. Installing ASHPs also converts gas heat to electric and should allow transfer to a lower Alabama Power heat pump rate plan. The expected useful life of A/C units is around 15 years and the current systems are from 2004. The cost associated with this project is the incremental difference between a standard unit and a higher efficiency one.

3. Low Flow Plumbing Fixtures

Existing toilets and urinals can be replaced with WaterSense certified fixtures and existing faucets can be retrofitted with low-flow aerators (down to 0.5 GPM). 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.

Additional detail can be seen in Appendix B.

4. Combustion Closet Weather Stripping

Adding weather stripping to the combustion closet housing the water heater (pictured at right) will reduce the infiltration of hot air in the summer and prevent the chimney effect of warm air escaping in the winter. This will reduce the heating and cooling loads of the building and will save HVAC energy.

Alternatively, if project #5 is pursued, the weather stripping does not need to be installed and the combustion closet outside vents can be sealed with R10 XPS and spray foam (Great Stuff, or equivalent).

5. Tankless Gas Water Heater (ROB in 2019) and Seal Hi/Lo Vents

Southface recommends replacing the water heater with a 95%+ efficient tankless gas water heater or a heat pump water heater (HPWH) which is more than two times as efficient as a standard electric water heater. Either model will allow the hi/low vents to be sealed (with R10 XPS insulation and spray foam) as outside air supply won't be necessary anymore. This will save on gas for water heating and heating cooling energy usage.

6. Solar PV (10kW)

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.

7. Maintenance: Combustion Closet Insect Screen

The insect screen on the lower vent in the combustion closet is out of place and should be either re-installed or replaced. The current orientation leaves the building open to insects and small rodents. Alternatively, if project #5 is pursued, the vents can be sealed permanently.

8. Maintenance: Wire OA Damper Correctly

The outside air (OA) damper appears to have never been wired to the A/C unit, which means the damper is permanently closed. Therefore, there is almost no outside air being supplied to the building currently, making it an indoor air quality (IAQ) issue, especially during the COVID-19 pandemic in a building with an at-risk population. The damper should operate to open whenever the air handler blower is on.

9. Maintenance: Clean A/C Condensate Traps

The p-traps on the air handlers were discovered to be clogged and condensate was leaking around the base of the evaporator coil into the condensate drip pan. Rust can be seen in the condensate pan and it's likely that mold is growing inside the evaporator coil because of the standing water that has backed up inside the unit.

Existing Building Conditions

Building Envelope

The senior center is a wood-framed brick building with double pane windows, a vented attic with blown-in insulation, and an asphalt shingle roof. Projects #4 and #5 address the envelope issues observed on site.

Lighting

Indoor lighting is entirely T8 tube fluorescent, with some CFL and halogen lights outdoors. Retrofitting all lights to LED and adding vacancy sensors to appropriate areas such as the library, computer room, and break room can dramatically reduce lighting energy usage.

Plumbing and Potable Water Use

All plumbing fixtures are standard fixtures. The toilets and urinals could be upgraded to WaterSense fixtures and bathroom faucets retrofitted with lower-flow aerators (down to 0.5 GPM). Detail on savings can be seen in Appendix B.

Domestic Hot Water

The current water heater is a 40 gallon AO Smith standard efficiency gas unit from 2004. The expected useful life of gas water heaters is around 15 years, so it could be replaced at any time. A standard replacement is around $1000, so upgrading to a tankless condensing gas unit would be about $2000 more, resulting in a 22 year payback for the ROB scenario. If actual quotes for replacement are cheaper than $3000, then payback will be faster.

Health and Safety

The only health or safety issues are addressed by projects #7-9.

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	Lighting Controls	Controls % Savings	Annual kWh	Total Project Cost	Annual Cost Savings	Payback
Common Room	2x4 T8 2L	13	780	1,040	811	LED Retrofit Kit (30-watts; 4ft)	390	No Change	0%	406	$1,170	$88	13.2
Computer Room	2x4 T8 2L	4	240	1,040	250	LED Retrofit Kit (30-watts; 4ft)	120	Vacancy	26%	92	$445	$34	12.9
Library	2x4 T8 2L	2	120	1,040	125	LED Retrofit Kit (30-watts; 4ft)	60	Vacancy	26%	46	$265	$17	15.4
Break Room	2x4 T8 2L	4	240	1,040	250	LED Retrofit Kit (30-watts; 4ft)	120	Vacancy	26%	92	$445	$34	12.9
Entry/Halls	2x4 T8 2L	4	240	1,470	353	LED Retrofit Kit (30-watts; 4ft)	120	No Change	0%	176	$360	$38	9.4
Kitchen/Pantry	2x4 T8 2L	5	300	1,470	441	LED Retrofit Kit (30-watts; 4ft)	150	No Change	0%	221	$450	$48	9.4
Bathroom	2x4 T8 2L	4	240	1,040	250	LED Retrofit Kit (30-watts; 4ft)	120	No Change	0%	125	$360	$27	13.2
Outside	Halogen Flood Light (2x 35W)	4	280	3,996	1,119	LED Flood (2x)	120	No Change	0%	480	$120	$139	0.9
Outside	Pin Based CFL wallpack	2	48	3,996	192	Pin-based LED	24	No Change	0%	96	$30	$21	1.4

Appendix B: Low Flow Plumbing Project Detail

Existing						Proposed				Savings and Payback		
Area	Fixture Type	Qty	GPF/ GPM	Annual kGal		Proposed Fixture Type	Annual kGal	Annual Cost	Fixture Cost (Each)	Annual Savings kGal	Annual Cost Savings	Payback (Years)
Baths	Faucet	4	2.2	1.88	$15	Faucet Aerator - 0.5 GPM	0.4	$3	$5	1.5	$12	1.72
Baths	Toilet	3	1.6	2.58	$21	Toilet - 1.28 GPF	2.1	$17	$600	0.5	$4	435.30
Baths	Urinal	1	1	0.09	$1	Urinal - 0.125 GPF	0.0	$0	$600	0.1	$1	941.92
Kitchen	Sink	1	2.2	5.72	$46							
Mop Sink	Sink	1	3	0.09	$1							

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.

System Capacity: 10.0 kWdc (66 m2)

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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.

The names DOE/NREL/ALLIANCE shall not be used in any representation, advertising, publicity or other manner whatsoever to endorse or promote any entity that adopts or uses the Model. DOE/NREL/ALLIANCE shall not provide any support, consulting, training or assistance of any kind with regard to the use of the Model or any updates, revisions or new versions of the Model.

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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

13,100 kWh/Year*

System output may range from 12,429 to 13,461 kWh per year near this location.

Month	Solar Radiation (kWh / m² / day)	AC Energy (kWh)	Value ($)
January	3.38	796	174
February	3.90	817	178
March	4.98	1,147	250
April	5.88	1,254	273
May	6.33	1,364	297
June	6.53	1,333	291
July	6.26	1,329	290
August	6.13	1,290	281
September	5.47	1,133	247
October	4.84	1,072	234
November	3.85	864	188
December	2.98	702	153
Annual	5.04	13,101	$ 2,856

Location and Station Identification

Requested Location	434 Vine St. montevallo, al
Weather Data Source	Lat, Lon: 33.09, -86.86 0.6 mi
Latitude	33.09° N
Longitude	86.86° W

PV System Specifications *(Commercial)*

DC System Size	10.0 kW
Module Type	Standard
Array Type	Fixed (roof mount)
Array Tilt	20°
Array Azimuth	135°
System Losses	14.08%
Inverter Efficiency	96%
DC to AC Size Ratio	1.2

Economics

Average Retail Electricity Rate	0.218 $/kWh

Performance Metrics

Capacity Factor	15.0%

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