

Huntsville Utilities Climate Pollution Reduction Grants – Implementation Grants Application

1. OVERALL PROJECT SUMMARY AND APPROACH

Huntsville Utilities will be submitting for two separate measures within this application. The first, and henceforth known as Measure 1, will electrify a portion of Huntsville Utilities' fleet. The second measure, and hereinafter known as Measure 2, will create microgrids in certain locations of the Huntsville Utilities service area with a focus on low-income and Disadvantaged Communities, as defined by EPA's EJScreen mapping tool, which will increase the resilience of the electric grid in these areas.

Measure 1 corresponds to the measure listed in the Alabama Department of Environmental Management's (ADEM) PCAP on page 26, Measure 1: Huntsville Utilities Fleet Electrification. Measure 2 corresponds to the measure listed in the ADEM's PCAP on page 31, Measure 2: Huntsville Utilities Microgrid with Battery Storage.

a. Description of GHG Reduction Measures

Measure 1:

This workplan outlines in detail Measure 1 of Huntsville Utilities' application, the scope of work, GHG reduction measures, environmental and transformative impacts, and benefits to be gained by low income and disadvantaged communities from the project implementation. These assessments will involve both qualitative and quantitative analysis. In the final sections, an evaluation of Huntsville Utilities' job quality profile, capabilities, and staff expertise is carried out in detail, concluding with a budget description of the materials, equipment, infrastructure, and all relevant costs needed to make the project and its implementation a success. Criteria on page 52 of the NOFO document has been used as a guideline. This measure corresponds to and is the exact measure listed on page 26 of ADEM's PCAP, Measure 1: Huntsville Utilities Fleet Electrification. This project was submitted to ADEM and included as an official measure in ADEM's PCAP.

Measure 1 of Huntsville Utilities Fleet Electric Vehicle (EV) Deployment involves the replacement of 14 internal combustion, gas-powered vehicles with 14 electric vehicles, the installation of EV chargers, and workforce development required to adequately operate and maintain the vehicles. A detailed breakdown is provided below.

- The purchase of twelve 2023 (or current year model) Ford F-150 Lightning Pro 4WD pickup trucks and 2 Mustang Mach-E Select electric vehicles for GHG emission reduction.
- The Installation of Type 2 EV charger systems located at each of the 3 Huntsville Utilities main operating locations.
- The Installation of DC fast charger systems at each of the 3 Huntsville Utilities main operating locations.
- The acquisition and development of fleet technicians to repair and maintain electric vehicles, regular training of fleet staff specific to electric vehicles and the purchase of tools, equipment and software required to diagnose and resolve any operating issues.

The implementation of Measure 1 will begin in Year One with the construction of charging systems at the Chase Operations facility and will also include the hiring of an experienced fleet technician to assist with

EV training and workload, the purchase of any necessary tools and equipment, and five of the electric vehicles. Year Two will include construction of charging stations at the Triana Operations facility and the purchase of five more electric vehicles. Year Three will include construction of charging stations at the Downtown Administrative facility and the purchase of the remaining four electric vehicles.

The twelve pickup trucks will be used by the utilities' Engineering and Operations staff, and the two passenger vehicles will be used by the External Affairs Department for marketing purposes. Charging stations will be used solely for utility purposes since some locations will not be accessible to the public.

The primary risks identified with this approach will be related to supply chain issues. The supply and demand of electric vehicles, combined with any production delays by Ford will determine how quickly the vehicles can be placed into operation and the combustion vehicles currently in use can be removed from service. A similar delay could occur with the construction of the charging stations if materials are unavailable or scheduling issues arise with contractors. GHG emission reductions would be delayed as a result of any vehicle deployment issues but should still occur. Deployment of the electric vehicles and charging stations needs to coincide to reach the maximum effectiveness for this measure, as the delay of one will result in delays for the other.

Measure 2:

This workplan outlines in detail Measure 2 of Huntsville Utilities' application, the scope of work, GHG reduction measures, environmental and transformative impacts, and benefits to be gained by low income and disadvantaged communities from the project implementation. These assessments will involve both qualitative and quantitative evaluation with historical demand data and records. In the final sections, an evaluation of Huntsville Utilities' job quality profile, capabilities, and staff expertise is carried out in detail, concluding with a budget description of the materials, equipment, infrastructure, and all relevant costs needed to make the project and its implementation a success. Criteria on page 52 of the NOFO document has been used as a guideline. This measure corresponds to and is the exact measure listed on page 26 of ADEM's PCAP, Measure 2: Huntsville Utilities Microgrid with Battery Storage. This project was submitted to ADEM and included as an official measure in ADEM's PCAP.

Measure 2 of Huntsville Utilities Microgrid with storage involves the acquisition and installation of three grid scale batteries and the accompanying accessories needed for effective system performance both as standalone and grid connected systems. The tentative plan is to install two units of 4MW/16MWh total, at each of the Stringfield and Gurley locations, and one 2MW/8MWh total at the Pulaski Pike Center location. The North Huntsville location has been identified as a fourth potential site in case of any issues that may arise with the three previous locations earmarked for installation. The exact addresses are:

Stringfield 224 Distribution – 5760 Stringfield Rd, Huntsville, AL 35810;

Gurley 214 Distribution – 387 Gurley Pike, Gurley, AL 35748 ;

Pulaski Pike Center to be interconnected with HU's wheeler 224 distribution – to serve load downstream of the center at 1100 Pulaski Pike NW, Huntsville, AL 35816; and

North Huntsville Primary – 515 Oakwood Ave, Huntsville, AL 35816, is an alternate if unfavorable issues arise with any of the three locations above.

Figures 1-3 Show the distribution network for each of the sites and the planned locations for each of the storage units.

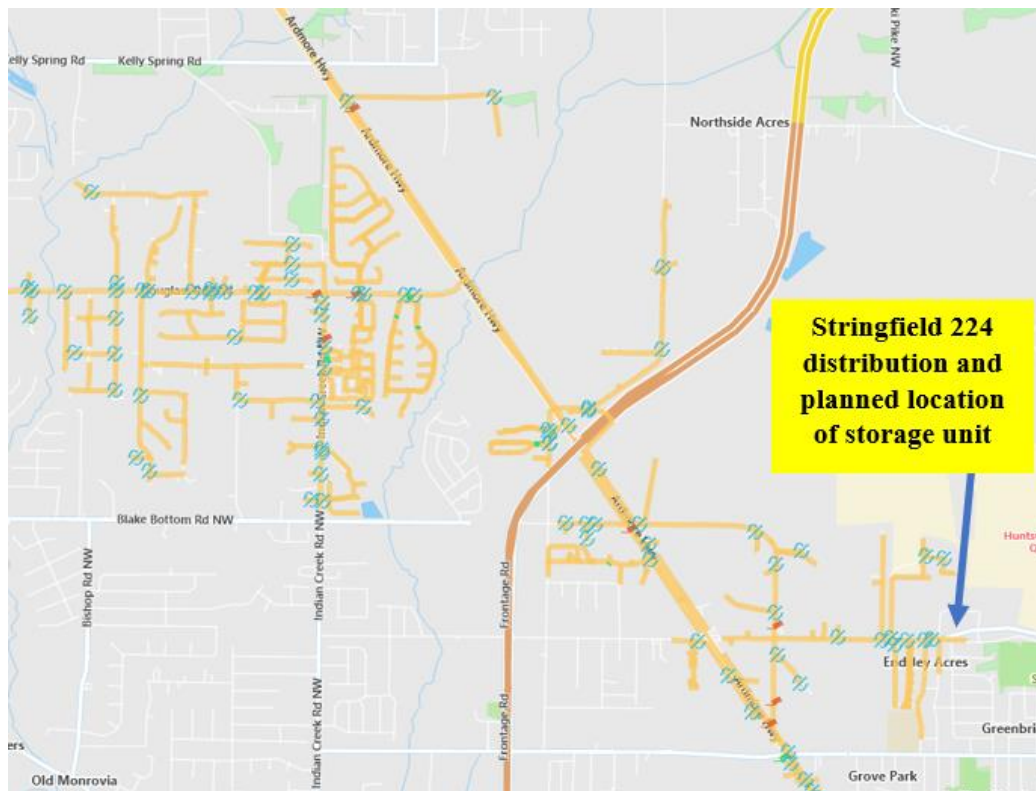


Figure 1. Planned location of storage unit at Stringfield

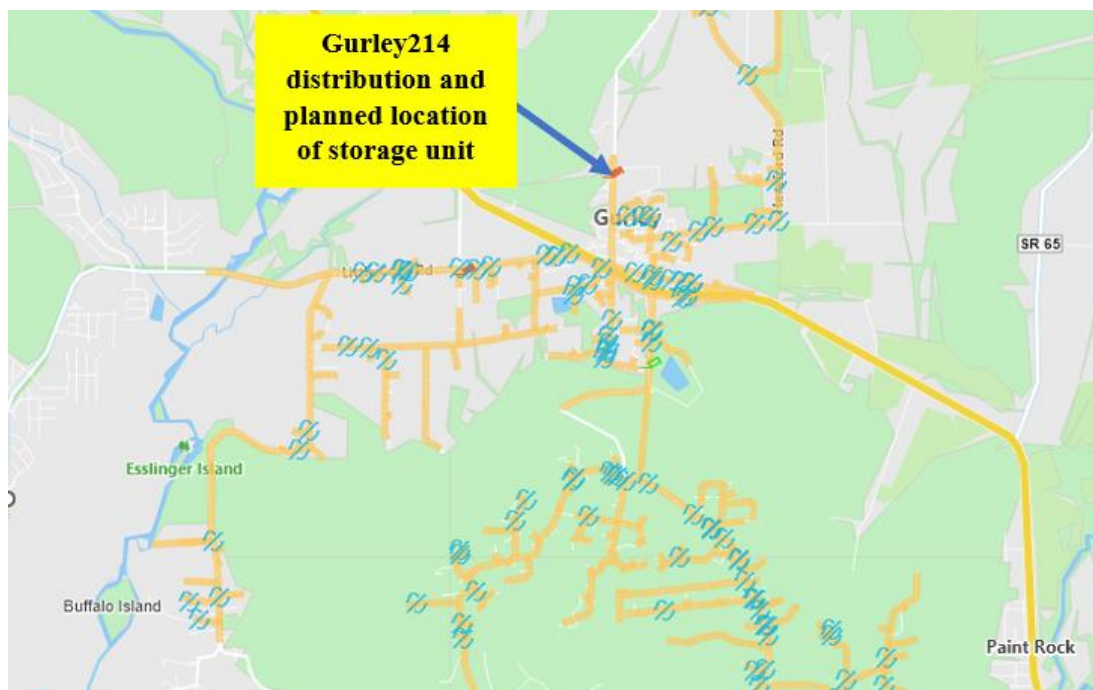


Figure 2. Planned location of storage unit at Gurley

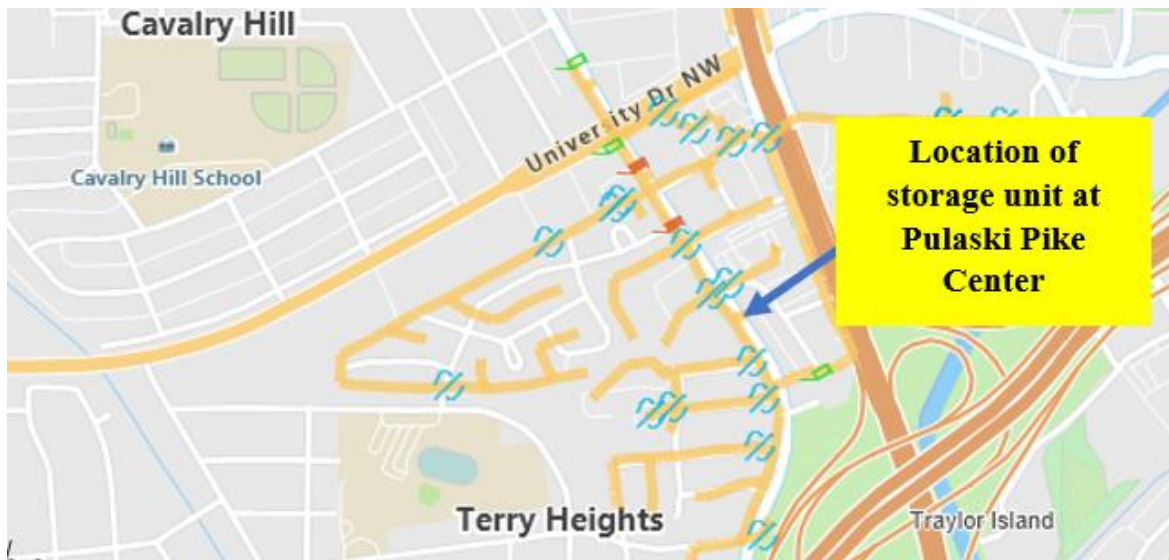


Figure 3. Planned location of storage unit at Pulaski Pike Center

These locations are all within Low Income and Disadvantaged Communities in Huntsville Utilities service territory. Except for the land at Stringfield, which is in the process of being acquired, all other locations are owned by HU and can accommodate storage unit connections to existing distribution networks. In addition to ensuring that project locations are in low income and disadvantaged communities, the locations have been carefully chosen for improved power quality and optimal GHG emission reduction strategies.

Necessary accessories to make the project a success include the installation of step-up transformers, control systems to communicate with Huntsville Utilities' SCADA system, switches, reclosers, appropriate protection, and metering schemes.

Major features of the batteries such as sizes and charging cycles have been established to ensure that there is adequate stored energy that can be discharged during peak load conditions. Similarly, the 4-hour charging cycle has been specified to ensure that during the duration of extreme temperature events the units can be used to shave off the peak load. The Stringfield and Gurley locations are known to have significant peak demand during extreme temperatures, which tend to result in low voltages and sometimes outages during such extremes. Whilst having a prime goal of GHG emission reduction for the project, reducing the probability of failure of the networks to the barest minimum for customers connected to the specified locations is an added benefit.

Tasks include:

1. Site acquisition, preparation and foundation works.
2. Battery and accessory specification development.
3. Acquisition and installation of three battery storage systems with two units having capacities of 4MW, 16MWh and one unit having a capacity of 2MW, 8MWh.
4. Acquisition and installation of accessories such as step-up transformers, control cabinets, wiring, switches, and reclosers.
5. Wiring and establishment of fiber communication protocols, protection schemes, etc.
6. Establishment of protection schemes and battery charging and discharging schedules using historical load profiles as a guide.
7. Engagements such as employee training and presentations at conferences.
8. System maintenance, monitoring, and data gathering and analysis for system evaluation.

The tasks above will be used to set key milestones. Task 7 will be initiated as soon as the grant contract is signed and will be completed within the first two years. Task 8 will then continue concurrently with other tasks through to at least year 5. Tasks 3, 4, 5, and 6 will be completed within years 2 and 4. In the 5th year, system monitoring, data gathering and analysis for system evaluation of the project will be carried out. By the end of the 5th year, the project will be fully operational.

Land is one of the potential risk factors that can hamper the smooth implementation of such a project. Both availability and appropriateness of use can be major issues. The team has identified four potential sites, even though there are only three planned installations. Except for Stringfield, all the identified locations are HU owned property, and this mitigates land related issues. Huntsville Utilities is in the process of acquiring land at Stringfield to accommodate growth related issues in the area. The sales contract for the vacant property on Stringfield was sent to the owner on Friday, March 22, 2024, and we are awaiting response from the property owner.

Another risk may be inadequate skill and the number of personnel. To mitigate this, a component of the project cost will be allocated for specialized skills that may be needed. Finally, supply chain-related risks can affect project timelines and completion dates. Huntsville Utilities' purchasing team have a track record of managing such supply chain issues in a very professional manner. The recent transformer related supply chain issues and how it has been successfully managed despite the increasing growth in Huntsville is a recent example to reference.¹

The locations have been prioritized to connect to Stringfield Substation 224 breaker, Gurley Substation 214 break, and along Wheeler Substation 224 breaker which feeds Huntsville Utilities' Pulaski Pike payment center.

This project will utilize battery storage to form a microgrid that achieves:

On the environmental front:

1. Reduced land degradation and water body pollutions due to a lesser need for electric generation and substation infrastructure footprint and reduced GHG emissions.²
2. Community beautification and greener environment due to a lesser need for electric generation and substation infrastructure footprint and GHG emissions.
3. Reduced particle pollution seen as ash and soot due to a lesser need for electric generation and, therefore, burning of fuels.
4. Reduced impact on climate change due to trapped heat as a result of reduced GHG emissions.
5. Improved public health due to reduction in GHG emissions, according to American Lung Association ³, electric utilities remain the Nation's largest industrial source of Carbon dioxide.

On the technical front:

1. Average reduction of 217,862 metric tons of GHG emissions over the next 25-year period that would arise from fossil fuels to generate the energy that will be delivered by the Battery Energy Storage System (BESS) as a renewable source of energy. There are other pollutants like sulfur dioxide, nitrogen oxides, carbon monoxide, and mercury, they have not been quantified because GHG is known to be the major byproduct of fossil fuels in the generation of electricity.
2. Reduced transmission and transformer losses when power is discharged from storage units. Reduced losses are tantamount to reduced GHG emissions. This also improves power quality for all the low-income and disadvantaged customers on Stringfield 224, Gurley 214, and Wheeler 224 distribution networks.
3. Reduced loading on transformers and improved resiliency to connected customers in LMI and DAC areas during peak conditions. In Figure 4, the peak seen by the connected transformer at the

substation can be reduced from about 900A to 600A. See time series plot of loading on one of the distribution circuits below. Figure 4 is just for illustration; the trends may vary for each of the three circuits.

4. Delayed capital investments, due to improved utilization of existing infrastructure. As can be seen in Figure 4, charging the batteries during off peak times when TVA's base load generation is nearly carbon free with primarily nuclear and hydro reduces GHG emissions to the barest minimum.
5. Provide backup power to some essential connected loads for a couple of hours in the event of outages at the substation.
6. Improved load factor as can be seen in Figure 4 for each of the circuits.
7. Reduced tariffs that would have been incurred serving peaky demand scenarios off the grid.

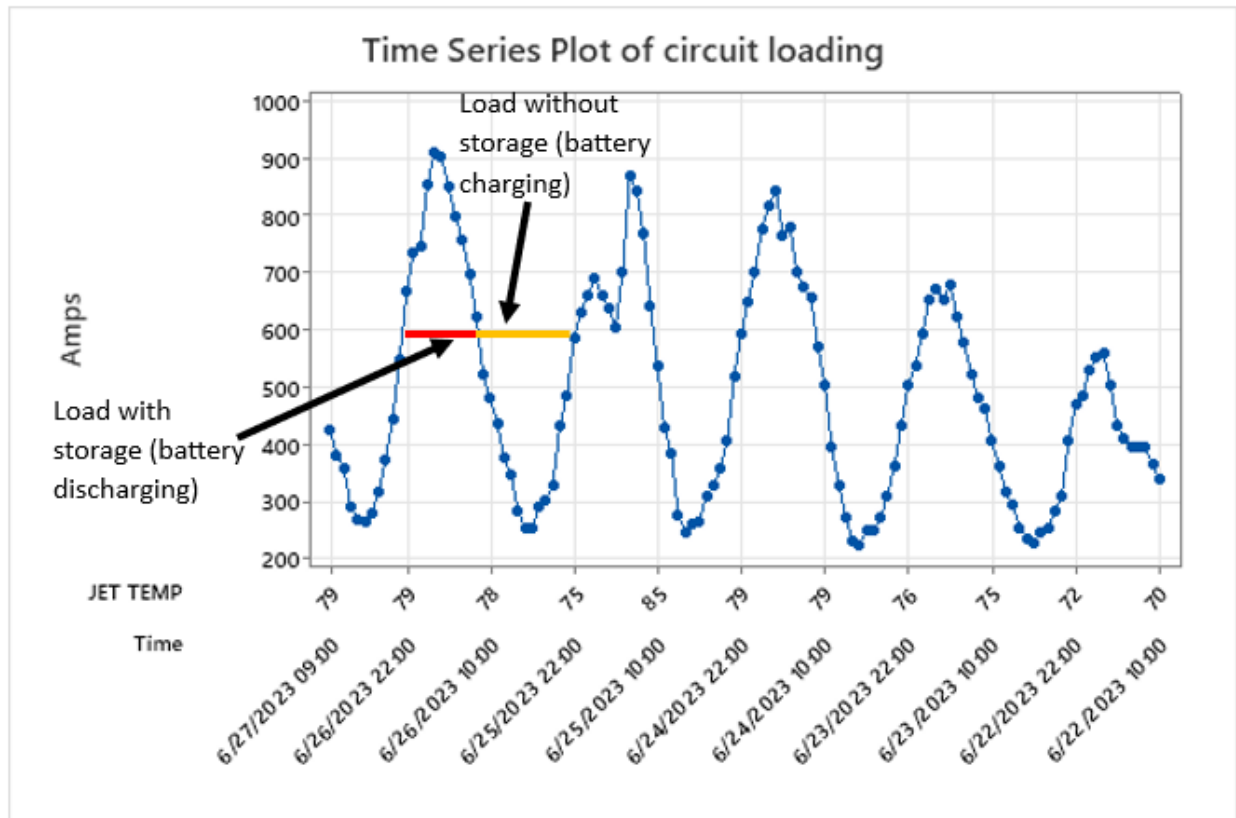


Figure 4. Time series plot for a typical peaked circuit

b. Demonstration of Funding Need

Huntsville Utilities is a cost-based entity, meaning rates for our utility services can only cover the cost of maintaining and operating the infrastructure. Due to the exponential growth our service territory has seen the past several years, all funding has been prioritized to capital projects that meet the needs of the growth as well as the maintenance and resilience of the grid. This is because planners of power system grids usually focus on the best use of the limited resources available to plan for infrastructure that can handle demand scenarios and not necessarily for GHG emissions reductions.⁴ With the needs of this growth and current operating costs, Huntsville Utilities is looking for any and all additional funding sources to back capital and supporting projects, such as these measures.

Over the past year, Huntsville Utilities has applied for several grants that included battery storage at grid-scale. In 2023, Huntsville Utilities was a recipient of a grant from the American Public Power Association for a battery storage project, and that project is in the planning and design phase. Currently, Huntsville Utilities is either working on submitting, or has already submitted, several grant applications that include grid-scale battery storage. These grants include a joint, regional application for the EPA Solar For All grant program and a joint, regional application for the DOE Grid Resilience and Innovation Partnerships with other local power companies in the TVA service area.

The Huntsville Utilities service area is subject to harsh storms with heavy winds and rains throughout the year that also include the potential of tornadic weather events, and the grid-scale battery storage will help ensure the resilience of the grid, reduce outages, and help shave off peak-load all while reducing emissions. With the previously mentioned growth, projects that serve to increase resiliency on the grid are of high priority.

Back in 2014, Huntsville Utilities was a recipient of funding from DOE and TVA for two electric pick-up trucks and two electric bucket trucks to add to our fleet. These electric trucks have either reached their useful life or are approaching their useful life, and it is nearing time to replace these trucks as well as grow the electric portion of our fleet. With the TVA portion of the funding, several electric charging stations were also installed at various Huntsville Utilities facilities. However, the addition of more electric vehicles will call for more electric vehicle chargers. Until now, Huntsville Utilities' focus has been on planning for and supporting the record growth in the area, which has also been the focus when applying for funding opportunities, so this will be the first funding opportunity since the DOE and TVA funding that Huntsville Utilities has sought after for EVs for its fleet.

c. Transformative Impact

Measure 1:

The introduction of more EVs into the utility's fleet will increase the overall market penetration of EVs in the Huntsville/Madison County area, which could aid in the increase of services offered for EVs, such as charging stations, in the area. The use of more EVs by the utility could also increase the number of residents in the area investing in an EV for their personal use as they see and hear about the benefits of EVs from Huntsville Utilities.

Measure 2:

This project, if awarded and implemented together with the awarded grant from DEED, will be used to empirically access and document the benefits any utility stands to gain with such GHG emission reduction strategies. A whole year has been allocated for data gathering and analysis as part of the project timelines. Establishing this project as a pilot will form the basis for a transformative opportunity to replicate such success across Huntsville Utilities' service territory. Not only does Huntsville Utilities stand to benefit from the GHG emission reduction and other gains, but TVA as well. TVA stands to gain immensely because part of the system generation will be sourced from the storage units. These batteries will be charged at off peak times when TVA's base load is nearly carbon free when nuclear and hydro generation are primarily utilized, leading to significantly reduced GHG emissions. All transmission losses and resources that would have resulted from the use of 20MWh of TVA generated power is eliminated. For Huntsville Utilities, this translates into the avoidance of higher tariffs during the peak demand periods, improved load factor, and the possibility of delaying capital-intensive projects. Additionally, this project will form the basis of empirically validating that the fact that if such a project is widely adopted, extreme temperature events that create high probabilities of failure for the power system grid can be scaled to less peak demand







scenarios for both TVA and Huntsville Utilities, and even other Power Purchase Agreements that adopt the implementation of such projects.







2. IMPACT OF GHG REDUCTION MEASURES

a. Magnitude of GHG Reductions from 2025 through 2030

Measure 1:

The reduction measure implemented in this proposal for grant funding is the deployment of electric vehicles and charging stations for utility operations purposes. Although a significant cost to the project, the Type 2 and DC fast charging stations are not expected to provide significant emissions reductions. The primary driver in emission reductions will be the replacement of gasoline and diesel-powered vehicles with electric vehicles. To arrive at the estimated impacts, comparisons of operating costs for both gas-powered and EV Ford pickup trucks and passenger vehicles were performed using the DOE Alternative Fuels Data Center vehicle cost calculator (<https://afdc.energy.gov/calc/>). The initial results are shown below.

Vehicle	Annual Fuel Use 	Annual Electricity Use 	Annual Fuel/Elec Cost 	Annual Operating Cost 	Cost Per Mile 	Annual Emissions (lbs CO2) 
2023 Ford F-150 Lightning 4WD Extended Range EV	0 gal	7,543 kWh	\$987	\$3,279	\$0.20	7,562
2023 Ford F150 Pickup 4WD FFV	884 gal	0 kWh	\$2,704	\$5,208	\$0.32	21,211

Vehicle	Annual Fuel Use 	Annual Electricity Use 	Annual Fuel/Elec Cost 	Annual Operating Cost 	Cost Per Mile 	Annual Emissions (lbs CO2) 
2023 Ford Mustang Mach-E RWD EV	0 gal	5,444 kWh	\$712	\$3,005	\$0.18	5,458
2023 Ford Explorer RWD Gasoline	782 gal	0 kWh	\$2,393	\$4,897	\$0.30	18,771

The difference in annual CO₂ emissions for the truck was 13,649 lbs and for the passenger vehicle was 13,313 lbs. When converted from pounds to metric tons, the emissions reduction was 6.19 tons for the truck and 6.04 tons for the passenger vehicle. The proposal for this measure is deployment of twelve electric trucks and two electric passenger vehicles, but deployment will be staggered. Year One and Year Two would each see four trucks and one passenger vehicle deployed, which would equal 30 metric tons of reduced CO₂. Year Three would only see the deployment of four trucks, which is a reduction of 24.16 metric tons of CO₂. Using this approach, 429 metric tons would be eliminated in the first five years.

What is not considered in these calculations is the greater emissions reductions that might result from cleaner energy generation or lower emission reductions from EV waste and battery degradation. No other greenhouse emissions outside of CO₂ were considered.

Using the EPA Social Cost of Greenhouse Gases Application Workbook, the emissions reductions of this measure were modeled. The social cost of greenhouse gas emissions is the monetary value of the net harm to society from emitting a metric ton of that gas into the atmosphere in a given year. The chart below shows the result from 2025 through 2030. Depending on the discount rate used, it indicates that the present value of the emissions for that time period are between \$60,000 and \$180,000. Also, as previously stated, the cumulative emissions reductions from 2025-2030 is 429 metric tons of CO₂. For the year 2025, the annual emissions reductions is estimated at 49 metric tons of CO₂, and for every year after until 2030 it is estimated that there will be 68 metric tons of CO₂ annually.

Present and Annualized Values of CO2 Emission Changes (millions, 2023\$)			
GHG	CO2	CO2	CO2
Discount Rate	2.5%	2.0%	1.5%
Present Value in 2024 (2023\$)	\$0.06	\$0.10	\$0.18
Annualized Value (6 Years, 2023\$)	\$0.01	\$0.02	\$0.03

Measure 2:

There are two main sources of GHG emission reduction opportunities in this project. Emission reductions attributable to renewable energy generation and reduced transmission and power transformer losses. There is also the ability to use stored energy from batteries for a couple of hours during system outages as an added benefit.

	Source of GHG reduction	Quantity	kWh discharged 2025 - 2030	CO ₂ emitted 2025 - 2030 (In metric tons)
1	4MW, 4h charging cycle	2	46,720,000	33,033
2	2MW, 4h charging cycle	1	23,360,000	16,516
3	Reduced losses		3,504,000	2,477
	GHG emissions		73,584,000	52,026

Table 3. GHG reduction measure calculation during the first five years of the asset's life

The first two numbered items in Table 3 calculate emission reductions gained by using the three storage units as sources of energy instead of fossil fuel energy during periods of peak demand on Huntsville Utilities' grid. The attached Technical Appendix explains how we arrived at these numbers in detail.

As shown above in Figure 4, these batteries will be discharged during times of peak demand scenarios and will avoid dispatching fossil fuel energy sources from TVA. Fossil fuel as a generating source is known to produce the highest level of carbon dioxide emissions on the Power System Grid.⁵

Item 3 in Table 3 is attributed to the avoidance of transmission and power transformer losses because of the use of the batteries at the distribution level of the grid. With assumptions that will be clearly spelt out in section D, a total of **52,026 metric tons** of CO₂ emission can be avoided during the first five years of this project.

b. Magnitude of GHG Reductions from 2025 through 2050

Measure 1:

Using the same tool and modelling techniques, the present value of the emissions from 2025 through 2050 would range from \$290,000 to \$840,000 in 2023 dollars. The cumulative amount of GHG emissions from 2025-2050 equates to 1,769 metric tons of CO₂. In 2025 the annual emissions reduction is 49 metric tons of CO₂, and every year after until 2050 has an annual emissions reduction of 68 metric tons of CO₂.

Present and Annualized Values of CO2 Emission Changes (millions, 2023\$)			
GHG	CO2	CO2	CO2
Discount Rate	2.5%	2.0%	1.5%
Present Value in 2024 (2023\$)	\$0.29	\$0.48	\$0.84
Annualized Value (26 Years, 2023\$)	\$0.02	\$0.02	\$0.04

Measure 2:

The same reasoning has been used for Table 4 with the difference between Tables 3 and 4 being the period under study – 2025 through 2030 for Table 3 and 2025 through 2050 for Table 4. Items 1 and 2 stem from GHG emissions reductions from the use of storage units, while item three is the reduction due to losses that will be avoided in the transmission and power transformers. A reduction of 217,862 metric tons of GHG gas over the 25-year life cycle of the battery storage system from 2025-2049, or 224,358 metric tons of CO₂ from 2025-2050. These dates have been utilized to answer the application questions, but the actual operational dates of the microgrid and storage systems will go beyond 2050 if the grant is awarded.

	<i>Source of GHG reduction</i>	<i>Quantity</i>	<i>kWh discharged 2025 - 2050</i>	<i>CO₂ emitted 2025 - 2050 (In metric tons)</i>
1	4MW, 4h charging cycle	2	210,240,000	148,648
2	2MW, 4h charging cycle	1	83,220,000	58,840
3	Reduced losses		14,673,000	10,374
	GHG emissions		308,133,000	217,862

Table 4. GHG reduction measure calculation for the duration of the asset's life

c. Cost Effectiveness of GHG Reductions**Measure 1:**

The value of the requested funding divided by the sum of quantified GHG reductions.

\$4,247,714 funding request / 429 metric tons of CO₂ emission reductions = \$9,901/metric ton

Measure 2:

This measure of cost effectiveness has been calculated as the following:

CPRG implementation grant dollars/Metric ton of CO₂-equivalent emission reductions to be achieved from 2025–2030, which comes out to \$27,682,511/62,430 metric tons, thus equaling \$443 per metric tons.

The calculated measure assumes batteries are charged and discharged once daily over the period. Doing this twice a day to capture both morning and evening peaks will increase the numbers accordingly. Likewise reducing the frequency will reduce the numbers.

Though the GHG has been used as a measure of cost effectiveness in this evaluation, increased cost effectiveness will be achieved if reduced losses due to transmission and power transformers, avoidance of increased rate charges during the peak periods, ability to delay capital expenditure necessary to inject transformers and build substations, etc. are all quantified in monetary terms.

d. Documentation of GHG Reduction Assumptions**Measure 1:**

An optional GHG calculation worksheet will be attached to the narrative to further outline and explain how the emissions reduction for this measure were calculated, as well as in the required Technical Appendix.

Measure 2:

It is assumed that the units will be retired over a 25-year period. Table 5 lists assumptions and references used for developing the estimated GHG reduction measures.

The calculator⁶ gives the carbon dioxide equivalent of the kWh of electricity inputted, and so the task was to come up with the kWh usage anticipated over:

1. The first five years (2025 – 2030): Table 3; and
2. The lifecycle of the units (2025-2049): Table 4.

All CO₂ emissions numbers in the last columns of tables 3 and 4 have been sourced from using the kWh values ⁶, **62,430 metric tons** for the first five years and **224,358 metric tons** for 2025-2050.

Using a total project cost of \$27,682,511 the estimated cost per metric ton of CO₂ equals:

\$27,682,511/62,430 metric tons or \$443 per metric tons from 2025 – 2030; and

\$27,682,511/224,358 metric tons or \$123 per metric tons from 2025 – 2050.

	Value used in calculation	Reference	Comment
Estimated CO ₂ per kWh	Sourced from GHG equivalence calculator	⁶	Calculations from other sources referenced on EPA website were close to results from source 6. Therefore, source 6 is used for the calculations in Tables 3 and 4.
Battery life degradation (first 10 years)	0.8	⁷	The degradation factors vary depending on the type of battery.
Battery life degradation (Second 10 years)	0.75	⁷	Value that is typically used.
Battery life degradation Last 5 years	0.5	⁷	Value that is typically used.
Estimated project life	25 years		10-15 years is typically assumed. The calculations use a 25% degradation factor after 10 years and 50% after 20 years.
Estimated transmission loss	5%	⁸	This has been estimated to be between 5 to 7%. 5% has been used for this application.

Table 5. Assumptions and references used for GHG reduction measure calculations.

It is assumed that the units will be retired after the 25-year period. The Technical Appendix contains a detailed description of how the numbers in sections 2a and 2b were derived.

3. ENVIRONMENTAL RESULTS – OUTPUTS, OUTCOMES, AND PERFORMANCE MEASURES

a. Expected Outputs and Outcomes

Measure 1:

The expected outcomes of this funding opportunity are as follows:

Over five years, a reduction of 429 metric tons of CO₂ emissions. This goal will be achieved if the estimated difference in GHG emissions determined with the use of the DOE Alternative Fuels Data Center vehicle cost calculator is correct and the 14 electric vehicles can be obtained and deployed within the budget guidelines. This is also dependent on Huntsville Utilities retiring and/or decommissioning gas-powered vehicles with each EV deployment. If retired vehicles are sold or transferred to another owner, the utility will reduce its own emissions footprint, but those emissions will transfer to another party. There is also the possibility that vehicle shortages or expanded responsibilities will encourage utility and fleet management to keep gas-powered vehicles in service for legitimate business reasons. To counter this and meet the expected outcome, a 1:1 provision will need to be implemented to ensure that for every EV deployed, a gas-powered equivalent vehicle is decommissioned within a reasonable period. Records of sale to scrap yards, tag and licensing records, and accounting entries showing asset retirement should provide documentation that the decommissioning has occurred. Similarly, titles, licensing, and accounting records would also provide proof of EV deployment. The fiscal year for Huntsville Utilities runs from October through September and vehicle purchase orders are usually created within the first month. To assist with governmental reporting, electric vehicle orders could be delayed until January 1 of the following year. The Huntsville Utilities Purchasing department will handle all purchases in accordance with the State of Alabama bid law and Federal procurement requirements. The Huntsville Utilities Fleet department will take receipt of the vehicles, install any required branding and accessories, and distribute the vehicles for deployment. The Fleet Department would also be responsible for the retirement of gas-powered vehicles in conjunction with the Finance Department. Any compliance reporting can be handled by Fleet with assistance from the Huntsville Utilities Process Excellence (Internal Audit) group. By the end of Year One, 5 EVs should have replaced 5 diesel or gas-powered vehicles. By the end of Year Two, 10 total vehicles should have been replaced. By the end of Year Three, all 14 vehicles should be replaced. If for any reason the deployment falls behind, emissions reductions will be recalculated and communicated to the EPA, and steps will be taken to accelerate the deployment of the remaining EVs. If the availability of Ford EVs becomes an issue, suitable replacements from other manufacturers will be acquired to meet the desired emissions reductions.

Over three years, the deployment of three Type 2 charging stations and three DC fast charging stations. The approach to accomplishing this goal is very similar to other utility-based construction projects. The Huntsville Utilities Engineering Planning Department will take the lead on modelling changes to the electric grid and creating potential designs or could contract out those services. Bid invitations for construction will be published by the Purchasing Department. This Department will also receive bids, and a bid opening will take place and proposals will be evaluated, all in accordance with the State of Alabama bid law and Federal procurement requirements. A contract will be awarded and notice to proceed will be granted to the lowest responsible and responsive bidder. Permitting will be obtained and, if necessary, procurement of materials by the Purchasing department can begin. Once materials are available, site work, mechanical installation, and electrical installation will be performed by the contractor and closely monitored by the Huntsville Utilities Engineering Planning Department. Any relevant inspections will be coordinated with the City of Huntsville. A similar project was undertaken to install a Type 2 charger in 2020, and the project timeline was approximately three months. By the end of Year One, the Type 2 charging station and DC fast chargers should be in place at the Chase Operations facility. By the end of Year Two, the Triana Operations facility charging stations should be online. By the end of Year Three, the Downtown Administrative Facility Type 2 and DC fast charging stations should be complete. Any construction delays that threaten these milestones will be addressed with the contractors and communicated to the EPA.

Measure 2:

Over the lifecycle of the project, the project is expected to result in the following outputs and outcomes, which are subdivided in environmental and technical results.

Environmental Outcomes:

- Reduced land degradation and water pollutions;²
- Community beautification and a greener environment;
- Reduced particle pollution seen as ash and soot;
- Reduced climate change due to trapped heat; and
- Improved public health;³

Technical Outcomes and Results:

- A reduction of 224,358 metric tons of GHG gas emissions on average. This estimate excludes reduction in CO₂ emissions due to the use of storage units at the substation to serve some essential loads instead of use of conventional natural gas generators. The reduction in GHG emissions is based on an average usage plan, and this will be tracked to know the actual outcomes. Other emissions include benzene and formaldehydes.
- Reduced transmission and power transformer losses. This reduces the voltage drops upstream and provides improved power supply to customers on Stringfield 224, Gurley 214, and Wheeler 224 distribution networks. In the event of a power outage at the substation, the switches can be programed to supply power to some sections of the customers for a period. On Wheeler 224, for example, there is the potential to serve Sonny Hereford Elementary, Holy Family School, and Huntsville Fire Station 5 for a couple of hours during an outage. This prevents the use of generators that may emit CO₂ during an outage.
- Peak shaving and the resultant ability to delay capital projects such as construction of substations, circuits, and installation of transformers.

b. Performance Measures and Plan**Measure 1:**

Performance will be measured by the various stages of procurement and implementation of the electric vehicles and charging stations. As stated in the previous section, a schedule has been created for the start and completion of the procurement of the electric vehicles and the charging stations and when they will be put into commission for each year of the project. The results of Measure 1 will be evaluated based on the commissioning of the vehicles and the charging stations, as this will dictate the progress of the measure as well as the overall emissions reductions. Each time an EV is put into commission, the GHG emissions reductions calculated for each vehicle model will be tabulated and kept track of to determine the overall reductions of the measure.

Measure 2:

In section 1a, tasks and milestones for this measure were discussed. These milestones with established timelines will be used to form a critical path to be tracked for a successful and timely project implementation. With the APPA DEED grant underway, lessons learned will be documented and made assessable to all planning team members for a successful implementation of this measure.

In the 5th year of the project implementation, the plan is to dedicate a year to track outcomes, such as load factor and peak loading scenarios, for each of the three circuits.

Load Factor= kWh over a period/KW*time

Reduced kW (peak demand sourced from TVA) within the period, is our expectation. This provides better load factors (closer to unity) and improved utilization of installed infrastructure. Load factor will be monitored based on the two sources (battery and TVA) of supply. End of line voltages with and without the storage units will be monitored to confirm improvement in power quality.

c. Authorities, Implementation Timeline, and Milestones

Measure 1:

Huntsville Utilities is the sole applicant in this project and will be the only recipient of the funding. Funding will be used for contracting the various labor that is required to complete the installation of the chargers, but they are not subrecipients of the funding. Huntsville Utilities has been a partner in a project of similar scope for the installation of EV charging equipment. Thus, our project timelines for this portion of the measure are based upon previous, similar experience.

Tasks	From	To	Implementing entity
<i>Construction of Charging Stations at Chase Operations Facility</i>	Contract signing	End of Year 1	Engineering
<i>Hiring of an experienced fleet technician</i>	Contract signing	End of Year 1	Fleet and HR
<i>Purchase of necessary tools and equipment</i>	Contract signing	Contract signing	Purchasing
<i>Purchase of 4 EV trucks and 1 EV passenger vehicle</i>	Contract signing	Contract signing	Purchasing
<i>Construction of Charging Stations at Triana Operations Facility</i>	Year 2	End of Year 2	Engineering
<i>Purchase of 4 EV trucks and 1 EV passenger vehicle</i>	Year 2	End of Year 2	Purchasing
<i>Construction of Charging Stations at Downtown Administration Facility</i>	Year 3	End of Year 3	Engineering
<i>Purchase of Remaining 4 EV trucks</i>	Year 3	End of Year 3	Purchasing

Measure 2:

Implementation will involve engineering and operational staff with Huntsville Utilities Chief Operating Officer having overall authority. Using the milestones in section 1, and some experience from the implementation of the awarded DEED grant storage project, the critical path method will be used to establish the minimum time to complete the entire project. The Chief Operating Officer will delegate a project manager who will be the liaison with the relevant departments, such as purchasing, engineering, SCADA, and operational crews, for successful project implementation and monitoring. The ongoing awarded DEED grant project will provide a smooth learning curve for the project team.

Table 6 shows tasks, key milestones, and timelines that were discussed in section 1.

Tasks	From	To	Implementing entity
<i>Employee training and presentations at conferences</i>	Contract signing	Year 2	Engineering

<i>Site acquisition, preparation, and foundation works</i>	Contract signing	Year 2	Engineering and purchasing
<i>Battery and accessory specification development</i>	Contract signing	Year 2	Engineering
<i>Acquisition and installation of units</i>	Year 2	Year 4	Engineering, operations, purchasing, metering
<i>Acquisition and installation of accessories</i>	Year 2	Year 4	
<i>Establishment of communication protocols</i>	Year 2	Year 4	
<i>Establishment of protection schemes</i>	Year 2	Year 4	
<i>Establishment of battery charging and discharging schedules</i>	Year 2	Year 4	Engineering, operations, and metering
<i>System maintenance, monitoring, data gathering, analysis,</i>	Year 5	Year 5	Engineering, operations, and metering
<i>Tracking performance and outcomes</i>	Year 5	Year 5	Engineering, operations, and metering

4. LOW-INCOME AND DISADVANTAGED COMMUNITIES

a. Community Benefits

Measure 1:

For this proposal, all the greenhouse gas emission reduction measures related to deployment of EVs are designed for utility use. As a result, economic development, which is a normal benefit of EV charging stations, is not as relevant if the charging occurs only on utility property. However, there are health benefits that occur with lower pollution levels and lower GHG emissions that would benefit low income and disadvantaged communities. The U.S. Department of Transportation website indicates that the transportation sector is responsible for 29% of all U.S. GHG emissions, and 60% of those come from passenger vehicles ([US DOT Website](#)). The EVs that will be deployed by Huntsville Utilities would operate within the entire service area, which does include low income and disadvantaged areas according to the Climate and Economic Justice Screening Tool ([CEJST Census Tracts](#)).

The tracts identified as low income and disadvantaged areas in the Huntsville Utilities Service area in northern Alabama are:

Tract ID	County	Population
01089001301	Madison	3,335
01089001302	Madison	1,955
01089001200	Madison	2,698
01089002100	Madison	3,139
01089002200	Madison	1,787
01089002300	Madison	4,657
01089002501	Madison	3,313
01089000302	Madison	3,737
01089000202	Madison	3,712
01089002502	Madison	3,336
01089000702	Madison	2,441
01089003000	Madison	2,638
01089000602	Madison	2,062
01089000701	Madison	2,478
01089000502	Madison	2,438

01089000501	Madison	2,031
01089000301	Madison	3,849
01089000201	Madison	925

If awarded the grant, the Huntsville Utilities EEO/DEI group will work with management to develop reporting that tracks emission and health benefits, or avoided disbenefits, to these communities.

Measure 2:

Using the link: <https://screeningtool.geoplatform.gov/en/#8/33.469/-97.502>, the project identification team identified locations that are within the Low Income and Disadvantaged communities of Huntsville Utilities territory area. Consideration was given to:

1. Locations in Low-Income and Disadvantaged Communities where HU owns land.
2. Locations where optimal peak shaving can be achieved. These should improve the quality of power supply and optimize the use of installed equipment for the identified low-income and disadvantaged communities.
3. Reliability and resiliency of radial circuits that have no backup sources of supply. Gurley distribution circuit is one of such radial circuits. Instead of using natural gas generators during in the event of an outage, some essential loads like the payment center can enjoy back up supply from the storage units for a couple of hours.
4. Potential number of customers in low income and disadvantaged communities that will benefit from this GHG emission measure. Table 6 lists the identified locations and the number of customers that will benefit from this GHG reduction measure.

Location	Total number of connected customers	Essential and disadvantaged customers and other essential load
<i>Stringfield 224 Distribution</i>	1580	Chestnut Glen Apartments
<i>Gurley 214 Distribution</i>	1176	Gurley Gardens and Gate St Apartments? Piggly Wiggly, Gurley City Hall
<i>Pulaski Pike Center</i>	385	Sonny Hereford Elementary, Holy Family School. Potential to serve HSV Fire Station 5, and Pulaski Pike payment center

Table 6. Identified essential loads.

The census tract IDs and population of the three (3) identified locations are shown in Table 7 below.

Tract ID	Identified Location for GHG reduction measure	Population
1089001200	Pulaski Pike Center	2,698
1089000501	Stringfield 224 distribution	2,031
1089010902	Gurley 214 distribution	3,100

The metered quantity of demand that gets discharged from the battery units during the operational lifecycle will be used to assess the community benefits and emission reductions. The quality of power using indicators like voltages and losses will also be used as part of the quantitative assessments. Modeling and simulation of conditions with and without the storage units will all be reported and documented to show the added advantage of undertaking this GHG reduction measure.

The switching scheme for each of the circuits will be designed in a way to ensure as many customers as possible in the low income and disadvantaged communities benefit from back up supply of the storage units in the event of an outage. This will be used as the design scheme throughout the project lifecycle.

b. Community Engagement

Huntsville Utilities is assessing several sites for the installation of the micro-grid technology. To determine the best location for this technology that will create the largest impact for residents in disadvantaged communities, Huntsville Utilities plans to meet with community leaders of these areas and nonprofits that are established in and serve these communities. These conversations will help determine the areas of greatest need, as well as the areas with a larger amount of vital community facilities, such as schools, churches, local grocery stores, food banks, and more. Ensuring that not just the residents benefit directly but also the institutions that are vital to their community will help to ensure the resiliency and improve the vitality of these areas.

While the electric vehicles and charging stations being added to the Huntsville Utilities fleet will not directly impact residents, there will be significant benefits in terms of emissions reductions, which will create health benefits, and noise reduction, as EVs are quieter than gas-powered vehicles. These important benefits will be communicated to residents throughout the service area with a focus on the low-income and disadvantaged communities. Huntsville Utilities will also meet with community leaders and leading nonprofits in these areas to determine the impact and feedback of residents, which will help ensure a larger pool of residents will be heard.

5. JOB QUALITY

Measure 1:

Huntsville Utilities is committed to the idea of creating high-quality jobs within the local labor market and complies with “high road” labor practices that are consistent with the Departments of Commerce and Labor’s Good Job Principles. This particular measure to reduce GHG emissions may only create one job at Huntsville Utilities for an EV experienced fleet technician, but there will be opportunities created for local construction and technical firms to hire workers that meet those qualifications for the building and installation of charging structures. Huntsville Utilities employs a compensation analyst that regularly evaluates and compares pay levels with those of similar municipal utilities, industry standards related to job requirements, and local wage offerings. Huntsville Utilities also has an EEO/DEI group that monitors diversity in the workforce and promotes hiring from underserved communities and an inclusive work culture. Recent changes to the employee performance appraisal process have introduced a scoring element that adds weight to individual EEO/DEI compliance and learning and development. The Huntsville Utilities workforce is not unionized, but management strives to make sure that individual and collective voices are heard through a variety of accessible and easy to use communication methods.

Measure 2:

The current APPA DEED grant award provides a great learning opportunity that will avoid the steep learning curve necessary for the successful implementation of this GHG reduction measure. Almost all the GHG reduction project identification team members are engineers who are familiar with batteries and their mode of operations.

If this grant is awarded to Huntsville Utilities, the same team of managers, engineers, and other operational staff working on the DEED grant will be assigned to this GHG emission reduction measure. In the past two years, there have been conference presentations and training programs to ensure highly skilled workforce in this area are available for the implementation of any battery storage project. The project identification team take part in monthly TVA cohort meeting on battery storage to learn from other utilities like EPB that has several of such battery storage projects ongoing. In August last year, the project team visited EPB to learn more about their battery storage projects scalability, lessons learned, etc.

There is every effort to keep other departments like SCADA, budget and rates, and operational staff involved in the decision-making processes to ensure successful project implementations.

6. PROGRAMMATIC CAPABILITY AND PAST PERFORMANCE**a. Past Performance****1. Alabama Department of Environmental Management (ADEM) Drinking Water State Revolving Fund (DWSRF)**

- a. DWSRF funding is a capital grant from EPA to states that is then delivered to utilities through a revolving loan. For Huntsville Utilities, this funding has been utilized since 2021 for capital improvement projects either for the treatment or distribution of drinking water to Huntsville Utilities' service area.
- b. Contact Information: Julie Wade, ADEM, juliette.waid@adem.alabama.gov

2. American Public Power Association (APPA) DEED

- a. Huntsville Utilities was recipient in 2023 of the maximum possible award from APPA for their DEED program to install grid-scale battery storage on the Huntsville Utilities distribution grid. This project is currently in the design phase and could be used in tandem with EPA CPRG funding, should Huntsville Utilities be selected as an awardee.
- b. Contact Information: DEED@publicpower.org

3. Reporting Requirements**1. DWSRF Reporting:**

- a. All reports have been submitted to ADEM in a timely manner and have met all of the requirements and criteria outline in the agreement with ADEM.

2. APPA DEED Report:

- a. The award agreement for this funding opportunity was just recently completed and agreed upon in December 2023. As such, no reports have been submitted to date, as the first deadline has not been approached. However, Huntsville Utilities will uphold the

same performance as with the SRF funding and is confident that all reporting requirements and deadlines will be met.

4. Staff Expertise

Measure 1:

As previously mentioned, Huntsville Utilities (HU) participated in the Plug-In Hybrid Medium-Duty Fleet Demonstration and Evaluation Program that was sponsored by the Department of Energy (DOE) using American Recovery and Reinvestment Act of 2009 funding. The goal was to migrate plug-in hybrid electric vehicles technology to medium-duty vehicles in diverse applications. The reference project numbers are DOE FOA-28 award number EE0002549 and SCAQMD contract number 10659. HU had a supplemental project agreement with the Electric Power Research Institute (EPRI) and TVA that further covered the costs of these vehicles. Huntsville Utilities received 4 vehicles from this program. The vehicles have been utilized but suffered from poor performance and in October 2023, HU sought permission from the DOE to dispose of two of the vehicles and it was granted. To date, the vehicles are still in service. Huntsville Utilities complied with all portions of the award and subsequent agreements. This project has given HU experience not only in procuring and commissioning electric vehicles into its fleet, but also in managing award funding for the procuring and commissioning of electric vehicles into its fleet.

In addition to the above experience, Huntsville Utilities has been a partner in other projects for the installation of electric vehicle chargers for use by the public. These projects have given us insight into what it takes to plan, manage, and execute of project of this nature, and it also gives us timelines, metrics, and milestones of which to operate off.

Measure 2:

Huntsville Utilities has a DEED grant awarded project ongoing to install a 2MW, 4MWh unit with the goal of shaving off the peak load during extreme temperatures usually experienced in the summer and winter seasons. The project team for the battery storage project, mostly engineers, has used the preliminary stages of the current battery storage project implementation to increase staff expertise in the subject area of acquiring and installing battery units by:

1. Attending conferences to learn more about Battery Energy and Storage Systems. There were attendees from Huntsville Utilities at the Tennessee Valley Solar + Storage Conference held at Chattanooga in October 2023.
2. Visiting EPB for an onsite tour of installed battery storage projects.
3. Participating in programs by 7 States and TVA Cohort meetings.
4. Modeling and analyzing batteries as sources of supply in an electric distribution system – the modeling software Synergi has been used for such exercises.

Training and learning objectives for setting protection schemes, SCADA communication protocols, standards and specification, setting up charging and discharging schedules etc. are some continuous improvement goals for the project team members.

7. BUDGET

Measure 1:

A budget summary of the direct costs associated with implementing this measure is provided below and in tabular form at the end of the narrative. The total five-year budget for EV deployment by Huntsville

Utilities is estimated to be \$4,247,714. Of these costs, the two largest drivers are the purchase of 14 electric vehicles (\$845,930) and the construction of Level 2 charging stations and DC fast charging stations at the three primary Huntsville Utilities operating facilities (\$2,472,720). Other required costs to facilitate operations and maintenance are also included (\$929,064). Cost assumptions are based on online and physical research of historical costs and current pricing.

A detailed description of the budget and each relevant section is included in the attached budget narrative.

Measure 2:

The total budget for all five years of the project life for Measure 2 is \$27,682,511. Below is the high-level summary of the work that will begin and be completed within each year for Measure 2:

First Year: Preliminary design will be conducted to interconnect the Battery Energy Storage Systems (BESS) and microgrids, a consulting engineer will be contracted to assist with planning and preparation, site preparation will commence (prepare final site plan for all three (3) sites, install conduits, and install concrete pads), construction firm will be contracted to do the labor and installation, and fiber to the Gurley site will be designed.

Second Year: Installation of the BESS (3.9 MW / 15.7 MWh at a cost of \$7,011,890) at 5760 Stringfield Rd will begin and be completed within the second year. Fiber will be installed to 387 Gurley Pike (12 miles of fiber at \$40,000 a mile = \$480,000).

Third Year: Installation of the BESS (3.9 MW / 15.7 MWh at a cost of \$7,345,789) at 387 Gurley Pike will commence and be completed within the third year.

Fourth Year: Installation of the BESS at 1100 Pulaski Pike will commence and be completed within the fourth year.

A detailed description of the budget and each relevant section is included in the attached budget narrative.

References

1. Michael S. Huntsville's amazing population boom continues into 2024. Published 2024. <https://hvilleblast.com/huntsvilles-amazing-population-boom-continues-2024/#:~:text=Huntsville's%20population%20growth%20is%20real&text=The%20Rocket%20City's%20population%20in,3%2C000%20new%20residents%20every%20year.>
2. Melissa Denchak. Fossil Fuels: The Dirty Facts. Published 2022. https://www.nrdc.org/stories/fossil-fuels-dirty-facts?gad_source=1&gclid=EAIaIQobChMI88_4-eWZhQMV5i7UAR2OmwjEAAYAiAAEgJ_tfD_BwE#sec-what-is
3. American Lung Association. Electric Utilities Power plants that burn fossil fuels or other fuels for electricity also produce air pollutants that harm lung health. Published 2023. <https://www.lung.org/clean-air/outdoors/what-makes-air-unhealthy/electric-utilities#:~:text=Greenhouse%20gases.,drive%20changes%20that%20threaten%20health.>
4. Seifi H, Sepasian MS. Electric Power System Planning: Issues, Algorithms and Solutions. Vol 49. Springer; 2011.
5. Mostafaeipour A, Bidokhti A, Fakhrzad MB, Sadegheih A, Mehrjerdi YZ. A new model for the use of renewable electricity to reduce carbon dioxide emissions. *Energy*. 2022;238:121602.
6. EPA. Greenhouse Gas Equivalencies Calculator. <https://19january2021snapshot.epa.gov/sites/static/files/widgets/ghg-calc/calculator.html#results>
7. Lin Z, Li D, Zou Y. Energy efficiency of lithium-ion batteries: Influential factors and long-term degradation. *J Energy Storage*. 2023;74:109386. doi:10.1016/j.est.2023.109386
8. Shively B. How Much Primary Energy Is Wasted Before Consumers See Value from Electricity? Published 2024. https://www.enerdynamics.com/Energy-Currents_Blog/How-Much-Primary-Energy-Is-Wasted-Before-Consumers-See-Value-from-Electricity.aspx#:~:text=Transmission%20and%20distribution%20grid,transformers%20and%20other%20line%20equipment.