DEMONSTRATION PLAN

Underground Thermal Energy Storage (UTES) Technology Transfer

ESTCP Project EW18-5316

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Andrews, Hammock, & Powell, Inc.

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14. ABSTRACT

To increase awareness and implementation of the ESTCP demonstrated UTES technology, Andrews, Hammock & Powell, Inc., Consulting Engineers will develop an educational series of tools including seminars, webinars, websites, videos, guidelines, and software. The profession specific, on-demand webinars will be hosted for a minimum of two years on the National Institute of Building Sciences' (NIBS) Whole Building Design Guide website and will allow participants to be tested at the end of each Learning Module and receive Professional Development Hour (PDH'S) certificates and credits like AIA's Learning Units for their specific profession. The Department of Defense (DoD) has expressed interest in reducing its $4B energy utility bill, decreasing its water consumption and increasing its inside-the-fence energy security and resiliency. All three of these objectives were achieved under EW-201135 through the use of a rare (in the US) state-of-the-art form of energy storage known as UTES.

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Underground Thermal Energy Storage, UTES, Technology Transfer

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ACRONYMS AND ABBREVIATIONS

A&E – Architecture and Engineering
AEE – Association of Energy Engineers
AIA – American Institute of Architects
ASHRAE – The American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASME – The American Society of Mechanical Engineers
BTU – British Thermal Unit = the heat energy required to raise 1 pound of water 1 ° F
CFM – Cubic Feet per Minute
COP – Coefficient of Performance = the energy delivered divided by the energy consumed
DOD – Department of Defense
ECIP – Energy Conservation Investment Program
ESPC – Energy Savings Performance Contracts
GPM – Gallons per Minute
HVAC – Heating, Ventilation and Air-Conditioning
IACET - International Association for Continuing Education and Training
NIST – National Institute for Standards and Technology
NIBS – National Institute of Building Sciences
PO – Performance Objective
UTES – Underground Thermal Energy Storage
WBDG – Whole Building Design Guide website

1.0 INTRODUCTION

To increase awareness and implementation of the ESTCP demonstrated UTES technology, Andrews, Hammock & Powell, Inc., Consulting Engineers will develop an educational series of tools including seminars, webinars, websites, videos, guidelines, and software. The profession-specific, on-demand webinars will be hosted for a minimum of two years on the National Institute of Building Sciences' (NIBS) Whole Building Design Guide website and will allow participants to be tested at the end of each Learning Module and receive Professional Development Hour (PDH'S) certificates and credits like AIA's Learning Units for their specific profession. The Department of Defense (DoD) has expressed interest in reducing its $4B energy utility bill, decreasing its water consumption and increasing its inside-the-fence energy security and resiliency. All three of these objectives were achieved under EW-201135 through the use of a rare (in the US) state-of-the-art form of energy storage known as UTES. Often associated with the better-known Geothermal Heat Pumps (GHP) form of Heating/ Ventilating/Air-Conditioning (HVAC) systems, UTES was critical to achieving all three of these objectives. This project aims to deliver accurate, fact-based user-relevant UTES information, disseminated through multiple channels by enthusiastic presenters and relevant media, to DoD personnel and potentially to markets beyond the Federal sector. As excitement builds, and understanding of the benefits UTES brings to organizations through increased energy/water efficiency, cost savings and inherent energy security/resiliency, it is expected that UTES will increasingly become the HVAC system of choice for thoughtful DoD decision makers.

1.1 BACKGROUND

With the billions of dollars DoD spends on energy and millions on water, this Technology Transfer project attempts to transfer the technology of UTES across the US to neatly intersect the energy-water nexus by significantly reducing both energy and water consumption at DoD facilities. Transferring the UTES technology will allow DoD to utilize the "inside the fence" (secure) native geology/ground water to store both waste heat and "waste cooling" to reduce electrical and water consumption and eliminate fossil fuel consumption and the associated emissions "on base".

- Current Technology Transfer State of the Art: Currently one approach to transfer a new technology in DoD is to collaborate with the private sector through Cooperative Research and Development Agreements. In addition to this DoD provides presentations, articles, and website info to transfer a new technology.
- Current State of Technology Transfer in DoD: An alternative tech transfer approach used by DoD is to utilize webinars along and conferences such as the Energy Exchange.
- Technology Opportunity: To expand the outreach targeting the technology transfer, a multitude of measures will be taken. A website will be created, on site seminars will be held, webinars will be hosted, newsletters will be created, videos will be created, etc. This approach will transfer the technology more efficiently than the standard procedure for transferring the technology by creating interest in the technology in the private sector and in DoD.

1.2 DRIVERS

- Executive Orders: EO 13423, EO 13514 – Energy Savings and Renewable Energy Use and EO (#tbd) - Executive Order Regarding Efficient Federal Operations, May 2018
- Federal Policy: Federal Leadership in High Performance and Sustainable Buildings MOU 2006 - Reduce the total ownership cost of facilities and improve energy efficiency

1.3 OBJECTIVE OF THE DEMONSTRATION

The objective of this project is to transfer the technology of underground thermal energy storage for many, varied ESTCP projects for both DoD and the private sector. The approach involved in the technology transfer involves creating a website promoting UTES, implementing on site seminars at various locations across the country, creating webinars and videos that focuses on the key aspects of UTES, creating fact sheets, and amending the Whole Building Design Guide to include aspects for UTES. A demonstration for technology transfer of UTES is needed to spark interest, and overcome the fear of the unknown in implementation of UTES throughout the US.

- Validate: To validate the demonstration, surveys will be given to attendees of the regional workshops and the on-demand webinars. Completing the surveys will be a pre-requisite of the attendees receiving PDH/AIA credits for the course. An average 3.5 star rating with a 1-5 star rating scale will be considered a success.
- Findings and Guidelines: Findings from the demonstration may influence DoD and civilian project managers/owners to request UTES in the design of their systems.
- Technology Transfer: The demonstration will create the conditions to facilitate transfer of the process to other DoD technology demonstrations and projects by creating interest and discussion among DoD and the private sector concerning UTES technology. By training Engineers, Architects, Owners, Facility Managers, and Maintenance Personnel, the transfer of the technology will take a more natural course of action since much of the mystery of the technology will be uncovered.
- Acceptance: Once key players in the building design are educated on how UTES works, along with the energy savings and dependence benefits of UTES, it will be more accepted as a practical and energy efficient way to store energy for use during times of need.

2.0 TECHNOLOGY DESCRIPTION

2.1 OVERVIEW OF TRANSFER METHODOLOGY

The approach to this technology transfer project is to develop an educational series of tools including seminars, webinars, a website, videos, guidelines, and UTES software. The project team will develop and use this approach throughout DoD by promoting use of these tools at on site seminars, in newsletters, and through the uteshub.com website.

- Description: The approach to this Technology transfer will be much like social networking. Increasing interest across the United States will ultimately start the snowball effect of striking interest in the use of UTES systems.
    - The first step in this system involves the creation of the UTEShub.com website. This website is dedicated to the advancement of UTES for DoD and beyond. Traffic to this website will be increased through the use of a Blog Page where a scheduled Blog will be written with updates to projects and design of UTES systems. This blog will be posted to the home page of the website and will have the capability of being shared on social media sites. The website will also contain all information needed about UTES systems, as well as links to videos, webinars, and other tools such as UTES feasibility software. An example homepage of the UTEShub.com website is shown in Figure 1.
    - Regional workshops will be performed at military installations across the U.S. to educate Engineers, Architects, Owners, and Maintenance Personnel in the area of UTES. These workshops may be held at locations outside the fence of the military installation such as a museum to eliminate any issue with credentialing.
    - Six profession related on-demand webinars will be hosted on the NIBS WBDG website. The webinars will be related to specific professions such as Engineering/Architecture, Operators, Installers/Drillers, Contracting Officers, Energy Managers/Master Planners, and Regulators. After participating in the webinar, the participant will complete an online test, and the test will be graded.
    - Six videos of key aspects of the UTES design and construction process including technical videos and construction videos will be created. The videos will be accessible through the UTEShub.com website and also through video platforms such as YouTube and Vimeo.
    - Quarterly newsletters and fact sheets starting in year two will be issued to a mailing list. The newsletters/fact sheets will highlight present design and construction UTES projects in DoD and/or other Federal/Government entities as well as the private sector.
    - The existing Environmental Guidelines established under EW-201135 will be expanded to evolve the guidelines into a powerful tool that could help the practitioner and decision makers more promptly assess the requirements and suitability of proposed buildings and project sites.
    - The existing UTES Screening Software Tool established under EW-201135 will be expanded to evolve the guidelines into a powerful tool that could help the practitioner and decision makers more promptly assess the requirements and suitability of proposed buildings and project sites. An example homepage of the UTES Screening Software is shown in Figure 2.

- High quality one-page illustrated fact sheets will be created to provide an "at a glance" of some key aspects of UTES system designs, implementations, financing, costing, etc. These fact sheets will be sent to peers in DoD and in the private sector on a mailing list.
- A comprehensive update to the Whole Building Design Guide (WBDG) Unified Facility Guide Specifications (UFGS) will be performed so that the committee could see most of the innovations that have occurred in non-UTES (conventional) and UTES systems since the specs were previously written.

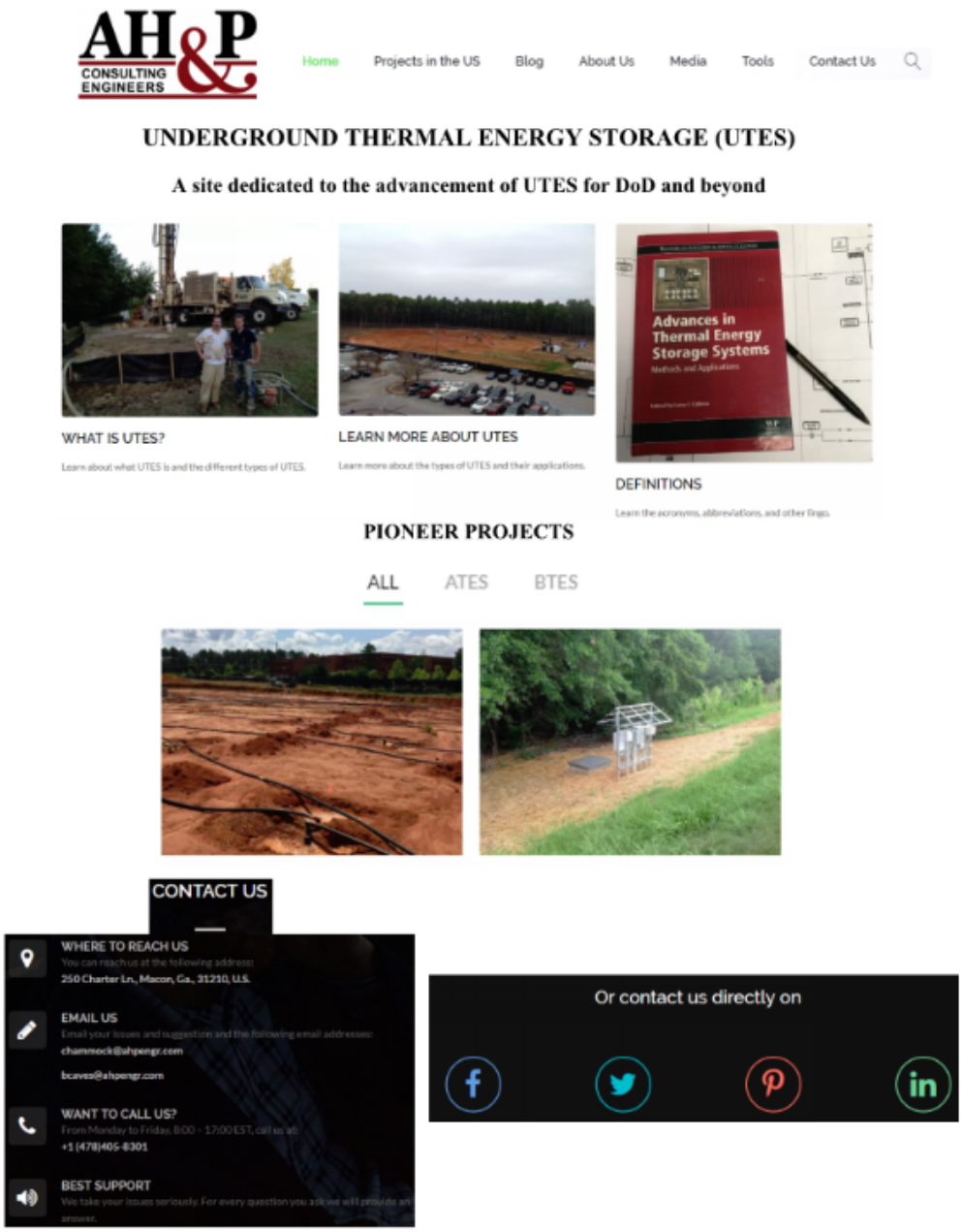

Figure 1 Sample UTEShub.com Webpage

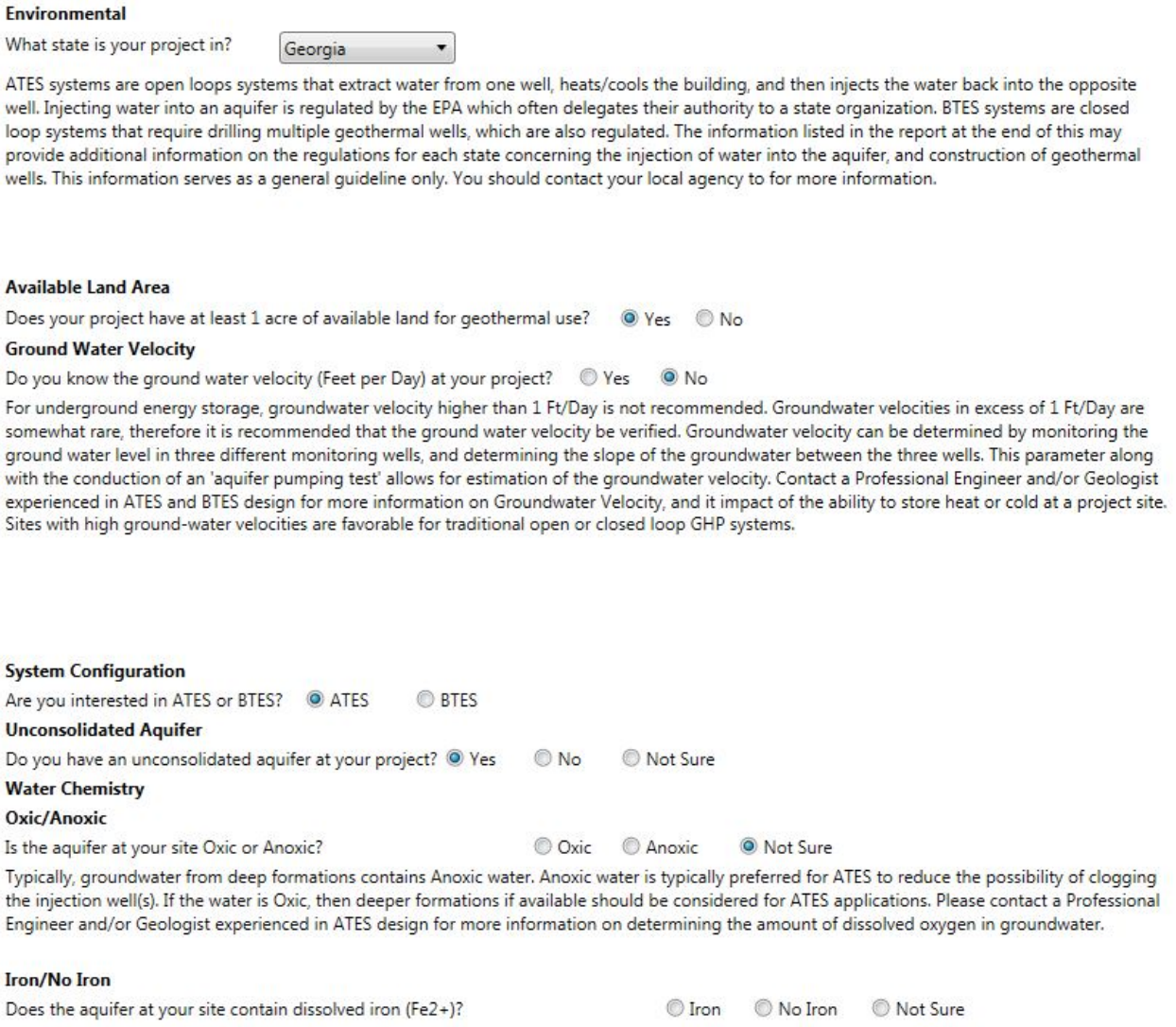

Figure 2 Sample UTES Screening Software

- Chronological Summary: The development of the technology transfer process over time will greatly depend on the amount of participation in the seminars, webinars, and other learning modules from DoD and the private sector. Over the end of the 3 year technology transfer project, it is anticipated that UTES projects will start to become more wide spread in the market, especially in DoD. The UTEShub.com website will be up and running full speed by the end of the project first year. On site seminars will start during the project first year as well as webinars. Quarterly newsletters will be sent out starting in project year two. All tasks will continue through the end of the Technology Transfer project.

- Future Potential for DoD: The expected applications of the approach for this Technology Transfer is for DoD and the private sector to apply UTES technology in building designs, and other designs where it is feasible.

2.2 ADVANTAGES AND LIMITATIONS OF THE TECHNOLOGY

- Performance Advantages: The new approach of UTES has a great potential to increase efficiency of new and existing HVAC systems by utilizing storage of energy for use during times of increased demand. Energy security can also be achieved using UTES by reducing energy dependency. An inside the fence energy security approach can be achieved by utilizing UTES.
- Cost Advantages: The major cost considerations for UTES is the construction of the wells. In some areas of the country drilling in more feasible due to the amount of drilling competition. However the cost advantages of UTES combined with geothermal heat pumps vs conventional geothermal is substantial due to the reduces borehole lengths and reduced over-all number of boreholes. ATES system in particular have the greatest potential for reduced installation cost vs traditional geothermal. ATES systems utilize far fewer wells than BTES systems.
- Performance Limitations: A potential risk of the new technology is limited application and system complexity. Application of UTES can be limited due to geology restraints. System complexity can also be a limitation. It is very important to target maintenance personnel in the technology transfer process to enhance their knowledge in UTES systems.
- Cost Limitations: Cost limitations of UTES can be related to conventional air cooled systems. Most of the time traditional air cooled systems have a much lower initial cost, but UTES systems can have a much lower operating cost.
- Potential Barriers to Acceptance: Barriers to acceptance might include:

  1. A reluctance to implementing UTES by building managers/operators will be fear of a more complicated system. One may feel that they are unable to maintain the system. It is imperative for this technology transfer approach to target these type of personnel to educate them and give them a confidence in the new technology.

  2. Personnel may be reluctant to attend on-site seminars and webinars due to time constrains and current work load. It is important that PDH and AIA certificates be issued after attending the webinars/seminars to encourage participation.

3.0 FACILITY/SITE DESCRIPTION

The selected delivery venue for the project will mainly be online. The website and webinars will by definition be online. The seminars will take place at four different Department of Defense installations. The installations were chosen based upon areas where UTES can be implemented easily due to geology, climate, and or drilling costs. Military installations were selected for seminar locations since military installations can greatly benefit from this technology due to the energy security aspect of UTES to encourage DoD attendance and facilitate tours of the actual ATES (Ft. Benning) and BTES (MCLB) systems. The installations considered for the seminars are as listed below.

1. Fort Benning – Fort Benning, GA (Home of the ATES Project, EW 201135)
2. Washington DC – (Chosen as a good location for peers to gather, close to ESTCP)
3. Marine Corps Logistics Base – Albany, GA (Home of the BTES Project, EW 201135)
4. Naval Construction Battalion Center – Port Hueneme, CA (Possibly hold the seminar at the Seabees Museum.)
5. Joint Base San Antonio

3.1 GENERAL FACILITY/SITE SELECTION CRITERIA

- Geographic Criteria: The climate zones for each facility site are diverse since they are located in different areas of the country. Fort Benning and the Marine Corps Logistic Base has a very warm climate and the geology will produce adequate water. The Naval Construction Battalion Center located in Port Hueneme, CA and Joint Base San Antonio both also have a very warm climate, but are much drier than the southeastern US.

- Facility Criteria:
    - The onsite seminar at Ft. Benning will be held at the Infantry museum to help reduce badging issues for attendees.
    - The onsite seminar at the Marine Corps Logistics Base will be held on base due to the lack of a meeting area elsewhere in the close vicinity.
    - The onsite seminar in Washington DC will be held at a location to be determined at a later date.
    - The onsite seminar at Naval Construction Battalion Center – Port Hueneme, CA will be held at the Seabees museum to help reduce badging issues for attendees.
    - The onsite seminar at Joint Base San Antonio will be held at a location to be determined at a later date.

- Facility Representativeness: The locations of the selected installations are geographically located in areas where UTES is highly feasible. There are numerous military installations in the same geographic regions that have the same common characteristics and that may benefit from the demonstrated technology.

- Other Selection Criteria: Other criteria used in selecting the site was the proximity to the EW-201135 demonstrated projects. Ft. Benning is the home of the first ATES system in the US, and the Marine Corps Logistics Base is the home to the first BTES in the US.

3.2 DEMONSTRATION FACILITY/SITE LOCATION AND OPERATIONS *Not applicable*

4.0 PERFORMANCE OBJECTIVES

The technology being transferred is Underground Thermal Energy Storage, or more commonly known as UTES. There are two types of UTES that were previously demonstrated under ESTCP's Energy and Water EW-201135, Aquifer Thermal Energy Storage (ATES) and Borehole Thermal Energy Storage (BTES). The two technologies are described below.

1. ATES: An ATES system utilizes ground water contained in underground aquifers to store energy in the underground formation for use in the opposite season. In cooling mode, ground water is extracted from the cooling well(s) and used to cool the building. The resulting warm water is then injected into the warm well(s). In the heating mode, the system reverses to extract warm water from the warm well(s) to heat the building. The resulting cold water is then injected back into the cold well(s). During times when outdoor air conditions are favorable, a dry cooler is used to further cool the water before injecting into the cold well(s).
2. BTES: A BTES system stores energy for use in the opposite season in the underground formations similar to an ATES system. However, a BTES system utilizes closed loop vertical wells arraigned in a way that allows of either cold or warm water circulated through the center, and cold or warm water circulated through the perimeter of the borefield. (Depending on whether the building is cooling or heating dominated.) BTES systems will almost always feature a "hybrid" component to allow active charging of the BTES in the off season Two aspects of a BTES differentiate it from "conventional" closed-loop:
    a. Concentric thermal zones piped in series. This allows more efficient storage of the desired thermal energy at the "core" boreholes and dissipation of the undesired thermal energy at the "perimeter" boreholes.
    b. Reversing valves that allow the water to flow first to the core (charging) or perimeter (discharging).

The economic Performance Objectives for the Technology Transfer listed in the table below are described herein. There are no metrics used in the original technology demonstration to address in this Technology Transfer Approach.

1. **Deploy Regional Workshops** – AH&P will perform regional workshops at military installations across the U.S. to educate Engineers, Architects, Owners, and Maintenance Personnel in the area of UTES. These workshops may be held at locations outside the fence of the military installation such as a museum to eliminate any issue with credentialing. The Performance Objective is to deploy the regional workshops, and the Success Criteria is to have average of 10 people attending each workshop.
2. **Create UTES Website –** AH&P will build a UTES website (uteshub.com) to promote the technology of UTES. The website will feature current and past UTES projects design and construction techniques. The website will feature a Blog where frequent news and updates can be shared. The Performance Objective is to create the UTES website, and the Success Criteria is to have a total of 2,000 website views at the end of the technology transfer period.

3. **Issue Profession Related On-Demand Webinars –** AH&P will produce six profession related webinars. The webinars will be hosted on The National Institute of Building Science's (NIBS) Whole Building Design Guideline (WBDG) website www.wbdg.org. The webinars will be related to specific professions such as:
    - Engineering/Architecture
    - Operators
    - Installers/Drillers
    - Contracting Officers
    - Energy Managers/Master Planners
    - Regulators

    After participating in the webinar, the participant will complete an online test, and the test will be graded The Performance Objective is to Issue Profession Related On-Demand Webinars, and the Success Criteria is to have an average of 10 attendees per related on-demand webinars. The webinars will be available at no charge to the user.
4. **Creation of UTES Design & Construction Videos –** AH&P will create videos of key aspects of the UTES design and construction process including technical videos, and construction videos. The videos will be hosted either on YouTube, or Vimeo and will be accessible through the uteshub.com website. The Performance Objective is to create UTES Design & Construction Videos, and the Success Criteria is an average of 25 views per video.
5. **Creation and Distribution of Quarterly Newsletters and Fact Sheets –** Starting by Project Year Two, AH&P will create quarterly newsletters with updates concerning new and existing UTES projects in DoD, other Federal/Government entities, and private sector jobs. With our international connections, periodic developments in the international community will also be featured. The Performance Objective is to create and distribute the Quarterly Newsletters and Fact Sheets, and the Success Criteria is to have an email mailing list of a minimum of 100 participants.
6. **Personnel Satisfaction with Regional Workshops –** AH&P will issue comment sheets at the conclusion of each Regional Workshop to determine the satisfaction level of the personnel in attendance. The comment sheets will have an area for comments and a 1 to 5 star rating for the workshop. The Performance Objective is Personnel Satisfaction with the Regional Workshops, and the Success Criteria is an Average 3.5 Star Rating from a 1 – 5 Star Scale.
7. **Personnel Satisfaction with Profession Related On-Demand Webinars -** AH&P will utilize an online survey at the conclusion of each On-Demand Webinar to determine the satisfaction level of the personnel in attendance. The survey will have ask for comments and a 1 to 5 star rating for the webinar. The survey will need to be completed before the participant receives a PDH. The Performance Objective is Personnel satisfaction with profession related on-demand webinars, and the Success Criteria is an Average 3.5 Star Rating from a 1 – 5 Star Scale.

No metrics used in the original technology demonstration is addressed in this Technology Transfer approach. As a technology transfer project, there are no metrics for energy and water savings, direct or source fossil fuel emissions reduction, or construction cost reduction.

The proposed Technology Transfer process to transfer UTES should be effective based on several factors listed below.

- The regional workshops, the webinars, and the uteshub.com website will increase the awareness of UTES to Engineers, Architects, Owners, Maintenance Personnel, and others that may be interested in alternative heating and cooling methods.
- The quarterly newsletters and fact sheets will assist in informing procurement officials in the idea, and implementation of UTES. The newsletters and fact sheets will also keep Engineers updated on current and future projects as they progress.
- AH&P will complete a comprehensive update to the Whole Building Design Guide Unified Facility Guide Specifications as it relates to UTES with the hopes of increasing adoption of the new technology and hopes of RFP's requiring UTES.

AH&P will expand the existing Environmental Guidelines and existing UTES Screening Software Tool to assist Engineers, Architects, Owners, Maintenance Personnel, and others that may be interested in alternative heating and cooling methods in implementing UTES.

4.1 SUMMARY OF PERFORMANCE OBJECTIVES

Table 1. Performance Objectives

Performance Objective	Metric	Data Requirements	Success Criteria
Quantitative Performance Objectives			
Deploy Regional Workshops.	Number of People Attending the Workshops	Attendance Sign in Sheet	An average of 20 people attending each workshop.
Create UTES website	Website Traffic	Website Statistics	A total of 2,000 website views
Issue profession related on-demand webinars	Number of webinars attended	Webinar attendance	An average of 10 attendees per webinar.
Creation of UTES design & construction videos	Number of views of construction videos available on YouTube or Vimeo.	Statistics of Video Views.	An average of 25 views per video.
Creation and distribution of Quarterly Newsletters and Fact Sheets	Email list for newsletters and fact sheets	Newsletters and Fact Sheets	Email list of a minimum of 100 participants
Qualitative Objectives			
Personnel satisfaction with regional workshops	Comments from users	Survey	Average 3.5 Star Rating from a 1 – 5 Star Scale
Personnel satisfaction with profession related on-demand webinars	Comments from users	Survey	Average 3.5 Star Rating from a 1 – 5 Star Scale

4.2 PERFORMANCE OBJECTIVES DESCRIPTIONS

1. **Deploy Regional Workshops**
    - **Name and Definition – Deploy Regional Workshops,** AH&P will perform regional workshops at military installations across the U.S. to educate Engineers, Architects, Owners, and Maintenance Personnel in the area of UTES. These workshops may be held at locations outside the fence of the military installation such as a museum to eliminate any issue with credentialing.
    - **Purpose –** The *regional* workshops will be used to inform and educate Engineers, Architects, Owners, and Maintenance Personnel across the United States in the area of UTES. The workshops will be designed to create interest and discussion among peers in the industry to encourage the implementation of UTES.
    - **Metric –** To measure performance, the investigator will record the number of people attending the workshops deployed. The range of the number of attendees could be anywhere from five to 50 people attending each workshop.
    - **Data –** The data required to evaluate the metric will be the attendance sign sheet from each workshop. The sign in sheet will serve as a record of the number of attendees and the date, time, and place of each workshop.
    - **Analytical Methodology –** The type of analytical methodology used for this PO will be a simple map indicating where each workshop was located in the United States.
    - **Success Criteria** – The metric threshold value for this PO is an average of 10 people attending each workshop.

2. **Create UTES Website**
    - **Name and Definition – Create UTES Website,** AH&P will build a UTES website (uteshub.com) to promote the technology of UTES. The website will feature current and past UTES projects design and construction techniques. The website will feature a Blog where frequent news and updates can be shared.
    - **Purpose –** The purpose of the UTES website is to provide an online community to encourage the use of UTES throughout the Untied States. The website would also contain information to assist in the design and construction of UTES.
    - **Metric –** To measure performance of the objective AH&P will record the website views. The range of the number of website views could be 1,000-5,000 views during the Technology Transfer period.
    - **Data –** The data required to evaluate the metric will be website statistics. Website statistics can be viewed on the admin page of the website.
    - **Analytical Methodology –** The type of analytical methodology used for this PO will be a graph detailing the website views each month.
    - **Success Criteria** – The metric threshold value for this PO is website views on a minimum of 2,000 views.

3. **Issue Profession Related On-Demand Webinars**
    - **Name and Definition – Issue Profession Related On-Demand Webinars,** AH&P will produce six profession related webinars. The webinars will be hosted on The National Institute of Building Science's (NIBS) Whole Building Design Guideline

(WBDG) website www.wbdg.org. The webinars will be related to specific professions such as Engineering, Architecture, Building Maintenance, Energy Management, etc. After participating in the webinar, the participant will complete an online test, and the test will be graded before receiving a PDH/AIA certificate.

- **Purpose –** The purpose of the on-demand profession related webinars is to allow interested parties to receive information on design, construction, and maintenance of UTES systems. Participation of the on-demand webinars can be completed at the convenience of the individual since the webinars are not live and are hosted on the WBDG website.
- **Metric –** To measure performance of the objective AH&P will record the number of attendees of the webinars. The range of people attending webinars could be five to 20 webinar attendees.
- **Data –** The data required to evaluate the metric will be the number of attendees per webinar located on the WBDG website.
- **Analytical Methodology –** The type of analytical methodology used for this PO will be a simple chart illustrating the number of attendees per webinar.
- **Success Criteria** – The metric threshold value for this PO is to record a minimum of 10 attendees per webinar.

4. **Creation of UTES Design and Construction Videos**
    - **Name and Definition –** AH&P will create videos of key aspects of the UTES design and construction process including technical videos, and construction videos. The videos will be hosted either on YouTube, or Vimeo and will be accessible through the uteshub.com website.
    - **Purpose –** The purpose of creating the UTES Design and Construction videos is to inform interested parties of UTES design and construction processes.
    - **Metric –** To measure performance of the objective AH&P will record the views per video. The range of the number of views per video will be one to one to 50 views per video.
    - **Data –** The data required to evaluate the metric will be views of videos available on the UTES website.
    - **Analytical Methodology –** The type of analytical methodology used for this PO will be a chart number of views for each video that was uploaded and the content of each video.
    - **Success Criteria** – The metric threshold value for this PO is an average of 25 views per video or greater.

5. **Creation and Distribution of Quarterly Newsletters and Fact Sheets**

    - **Name and Definition – Creation and Distribution of Quarterly Newsletters and Fact Sheets,** AH&P will create quarterly newsletters and Fact sheets with updates concerning new and existing UTES projects in DoD, other Federal/Government entities, and private sector jobs. With our international connections, periodic developments in the international community will also be featured.

- **Purpose –** The purpose of creating the Quarterly Newsletters and Fact Sheets is to inform interested parties of progress and new technologies concerning UTES on current and future jobs, both domestic and international. The Fact Sheets and Quarterly Newsletters will be emailed to a list of people who subscribe to the email list through the uteshub.com website.
- **Metric –** To measure performance of the objective AH&P will upload the quarterly newsletters and fact sheets to SEMS. The start date of the quarterly newsletters and fact sheets issued can range from Summer of 2019 to Spring of 2020.
- **Data –** The data required to evaluate the metric will be the emails that contain the quarterly newsletters and fact sheets. The newsletters and fact sheets will be uploaded to SEMS.
- **Analytical Methodology –** The type of analytical methodology used for this PO will be a chart detailing when each newsletter/fact sheet was issued and the content of the newsletter/fact sheet.
- **Success Criteria** – The metric threshold value for this PO is the distribution of Quarterly Newsletters/Fact Sheets starting in summer of 2019 and continuing through the end of the Technology Transfer period.

6. Personnel Satisfaction with Regional Workshops

- **Name and Definition – Personnel Satisfaction with Regional Workshops,** AH&P will issue comment sheets at the conclusion of each Regional Workshop to determine the satisfaction level of the personnel in attendance. The comment sheets will have an area for comments and a 1- to 5-star rating for the workshop.
- **Purpose –** The purpose of issuing the comment sheets are to determine the satisfaction level of the personnel in attendance at the Regional Workshops. The comment sheets will also be used to help determine the amount of interest in UTES.
- **Metric –** To measure performance of the objective AH&P will collect and review the comment sheets. The comments and the ratings will be added to a spreadsheet and analyzed. The analyzed spreadsheets will be uploaded to SEMS. The range of ratings that is to be expected is 1- to 5-stars out of a total of five stars. 1-star meaning very dissatisfied with the workshop, and 5-stars meaning very satisfied with the workshop.
- **Data –** The data required to evaluate the metric will be the comment sheets collected at each Regional Workshop.
- **Analytical Methodology –** The type of analytical methodology used for this PO will be a spreadsheet detailing the results of the comments. The comments will be sorted and analyzed to determine the overall participant satisfaction with the Regional Workshops.
- **Success Criteria** – The metric threshold value for this PO is an average 3-star rating from the comment sheets.

7. Personnel Satisfaction with Profession Related On-Demand Webinars

- **Name and Definition – Personnel Satisfaction with Profession Related On-Demand Webinars,** AH&P will utilize an online survey at the conclusion of each

On-Demand Webinar to determine the satisfaction level of the personnel in attendance. The survey will ask for comments and a 1- to 5-star rating for the webinar. The survey will need to be completed before the participant receives a PDH/AIA.

- **Purpose –** The purpose of utilizing the online surveys at the conclusion of the webinars is to determine the overall satisfaction with the information received as part of the webinars.
- **Metric –** To measure performance of the objective AH&P will collect and review the online surveys. The comments and ratings from the online surveys will be added to a spreadsheet and analyzed. The analyzed spreadsheets will be uploaded to SEMS. The range of ratings that is to be expected is 1 to 5 stars out of a total of five stars. 1-star meaning very dissatisfied with the webinar, and 5-stars meaning very satisfied with the webinar.
- **Data –** The data required to evaluate the metric will be a record of the online surveys.
- **Analytical Methodology –** The type of analytical methodology used for this PO will be a spreadsheet detailing the results of the online surveys. The comments and ratings of the online surveys will be sorted and analyzed in the spreadsheets.
- **Success Criteria** – The metric threshold value for this PO is an average 3-star rating from the online surveys.

5.0 TEST DESIGN

- Fundamental Problem: This Demonstration will attempt to solve the fundamental problem of a lack of transferring technologies after they are initially demonstrated as part of ESTCP projects. The initial demonstration project of Underground Thermal Energy Storage coupled with ground source heat pumps creates a new approach to energy usage that can replace older technologies by seasonally and diurnally storing energy in the ground for use in the opposite season. This technology has only been implemented in the US on three other projects since the completion of the initial demonstration.
- Demonstration Question: Will this Technology Transfer approach create interest in UTES system and eventually lead to more projects that implement UTES?

The answer to the question will be found in the increased number of students who take the on-line training and to the responses found in the surveys rated to the acceptability of the training and potential for new student to be identified and new project to be initiated.

As a result, the traditional Demonstration Plan discussions normally found in sections 5.1-5.6 do not apply to this tech transfer project.

5.1 PERFORMANCE ASSESSMENT

The data analysis the investigator will use to evaluate each performance objective is a combination of attendance sign in sheets for on site seminars, UTEShub.com website statistics, webinar attendance statistics, statistics of video views, and surveys completed by the attendees of the on-site seminars and webinars.

- Performance Objective Analysis Overview: The rationale for the assessment procedures is to determine the effectiveness of promoting the technology to peers that do not have any, or very little experience with UTES.
- Statistical Methodologies: Statistical analysis will be used to determine the effectiveness of the UTEShub.com website. Website statistics can be accessed through the admin section of the website. See Figure 3.
- Graphical Methodologies: Bar charts will be used to illustrate the number of people attending the on-site seminars, and webinars. Bar charts will also be used to illustrate the number of video views.

Figure 3 UTEShub.com Statistics

6.0 COST ASSESSMENT

- The cost to develop suitable materials for presentations can vary greatly between onsite seminars, webinars, and video creations. Typically the majority of the cost is labor cost, but travel cost can be a larger expense if the on-site seminars are a long distance away from the presenter's hometown. The time required to prepare for on site seminars are basically the same as webinars. However, the material cost for on-site seminars can be more due to the need for posters, agenda sheets, etc.
- It is assumed that the best return on investment may be the webinars published to the NIBS website, since there is no travel involved. The materials and time required to prepare for both the webinars and the on-site seminars are virtually equal. The real investment on return will not be known until the results of the Performance Objectives are analyzed.
- The presentation cost of the on-site seminars is estimated at $250-$500 per seat (Assuming 40-20 people attending per seminar). The presentation cost of the webinars is also estimated at $500-$1,000 per attendee, but the cost per attendee for webinars has the potential of being much lower since the number of attendees are unlimited. (Assuming 20-10 people attending per seminar)
- The cost effectiveness comparison of onsite seminars versus webinars is that on-demand webinars have the potential to have a much lower cost compared to effectiveness.

6.1 COST DISCUSSION

As stated previously the actual costs for each of the products being produced cannot be known until all of the actual costs are analyzed. However, an estimate of the costs for each product is listed below for reference. These estimated costs are based on estimated labor costs (including subcontractors), and material costs.

- Webinars Estimated Cost – $7,300 per webinar.
- Web Development – $16,000 per major upgrade to the website.
- NIBS Materials & Comprehensive Update to the WBDG Unified - $100,000 over 3 years.
- Seminars – $26,000 per On-Site Seminar.
- UTES Screening Software Upgrade – $16,300 per Major Software Update.
- Quarterly Newsletters and Fact Sheets (Supported via mass email) – $1,000 per Newsletter/Fact Sheet.
- Creation of Construction Videos - $6,000 per video produced.

Table 2. Cost Model

Cost Element	Data Tracked During the Demonstration
Hardware capital costs	N/A
Installation costs	N/A
Consumables (1)	$9,550
Facility operational costs (2)	$7,900
Maintenance of Materials used for the TT process	N/A
Software and Website lifetime	N/A There are no components to degrade
Presenter training and travel	$19,853
Notes:	
(1) Consumables include items such as: Posters, Flyers, Fact Sheets, Stationary, Certificates, Food, Snacks/Drinks, other items consumed during Seminars, etc.	
(2) Facility Operation Costs include costs such as: Conference Room Rental Fees, Video Production, Webinar Management, etc.	

7.0 TECHNOLOGY TRANSFER

The planned activities to influence DoD and other installation energy and water communities to expand the usage of the demonstrated technology or methodologies are listed below.

- The creation of the UTEShub.com website. This website is dedicated to the advancement of UTES for DoD and beyond. The venue for the website will be online, and the audience targeted will be building operators, managers, Engineers, and Architects. The initial version of the website was published in the winter of 2018.
- Regional workshops (On-site seminars) will be performed at military installations across the U.S. to educate Engineers, Architects, Owners, and Maintenance Personnel in the area of UTES. These workshops may be held at:

    - Fort Benning – Fort Benning, GA (Home of the ATES Project, EW 201135) **To be held in the Fall of 2019**
    - Washington DC – (Chosen as a good location for peers to gather, close to ESTCP) **To be held in the Spring of 2021.**
    - Marine Corps Logistics Base – Albany, GA (Home of the BTES Project, EW 201135) **To be held in the Winter of 2019.**
    - Naval Construction Battalion Center – Port Hueneme, CA (Possibly hold the seminar at the Seabees Museum.) **To be held in the Spring of 2020.**
    - Joint Base San Antonio **To be held in the Fall of 2020.**
- Six profession related on-demand webinars will be hosted on the NIBS WBDG website. The webinars will be related to specific professions such as Engineering, Architecture, Building Maintenance, Energy Management, etc. After participating in the webinar, the participant will complete an online test, and the test will be graded. The webinars will begin to be hosted in the Fall of 2019.
- Six videos of key aspects of the UTES design and construction process including technical videos and construction videos will be created. The videos will be accessible through the UTEShub.com website and also through video platforms such as YouTube and Vimeo. Videos will be hosted beginning in the Fall of 2019 The audiences for the videos are building operators, managers, Engineers, Architects, and Owners.
- Quarterly newsletters and fact sheets starting in year two will be issued to a mailing list. The newsletters/fact sheets will highlight present design and construction UTES projects in DoD and/or other Federal/Government entities as well as the private sector.
- The existing Environmental Guidelines established under EW-201135 will be expanded to evolve the guidelines into a powerful tool that could help the practitioner and decision makers more promptly assess the requirements and suitability of proposed buildings and project sites. The guidelines will be revised at the end of project year two.
- The existing UTES Screening Software Tool established under EW-201135 will be expanded to evolve the guidelines into a powerful tool that could help the practitioner and decision makers more promptly assess the requirements and suitability of proposed buildings and project sites. Three versions of the screening tool will be uploaded, and it will be available for free download on the UTEShub.com website.
- High quality one-page illustrated fact sheets will be created to provide an “at a glance” of some key aspects of UTES system designs, implementations, financing, costing, etc. These fact sheets will be sent to peers in DoD and in the private sector on a mailing list. The fact sheets will be issued beginning in project year two.
- A comprehensive update to the Whole Building Design Guide (WBDG) Unified Facility Guide Specifications (UFGS) will be performed so that the committee could see most of the innovations that have occurred in non-UTES (conventional) and UTES systems since the specs were previously written. The timeline for the comprehensive update is to complete it during project year 3.

8.0 SCHEDULE OF ACTIVITIES

The schedule below shows the date and the anticipated duration of each task of the demonstration.

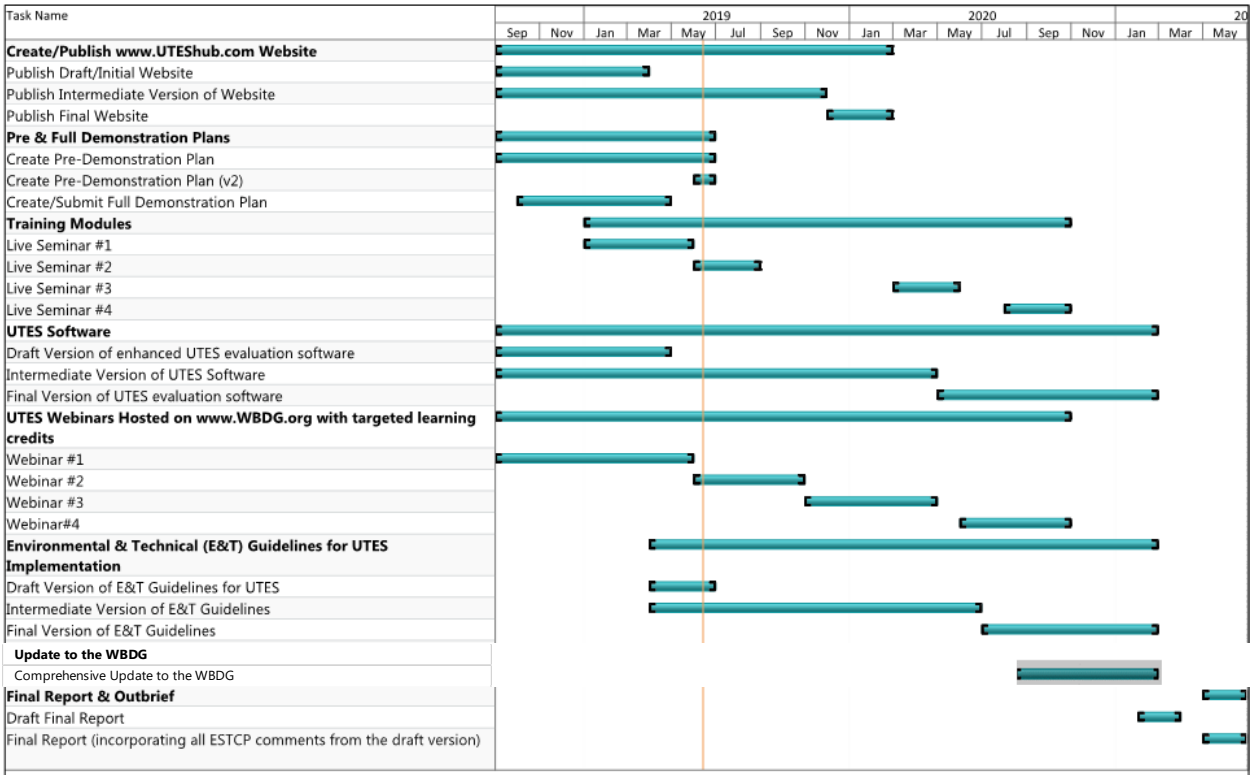

Figure 4 Gannt Chart

	DESCRIPTION	START	DUE	REVISED	DURATION
	2019 EW Spring In Progress Review and Downselect	June-19	June-19		0.00
1	**Create/Publish www.UTEShub.com Website**	**September-18**	**February-20**		518.00
1.1	Publish Draft/Initial Website	September-18	November-18	March-19	181.00
1.3	Publish Intermediate Version of Website	September-18	November-19		426.00
1.4	Publish Final Website	December-19	February-20		62.00
2	**Pre & Full Demonstration Plans**	**September-18**	**June-19**		273.00
2.1	Create Pre-Demonstration Plan	September-18	October-18	June-19	273.00
2.1	Create Pre-Demonstration Plan (v2)	June-19	June-19		0.00
2.2	Create/Submit Full Demonstration Plan	October-18	January-19	April-19	182.00
3	**Training Modules**	**January-19**	**October-20**		639.00
3.1	Live Seminar #1	January-19	March-19	May-19	120.00
3.2	Live Seminar #2	June-19	August-19		61.00
3.3	Live Seminar #3	March-20	May-20		61.00
3.4	Live Seminar #4	August-20	October-20		61.00
4	**UTES Software**	**September-18**	**February-21**		884.00
4.1	Draft Version of enhanced UTES evaluation software	September-18	April-19		212.00
4.3	Intermediate Version of UTES Software	September-18	April-20		578.00
4.4	Final Version of UTES evaluation software	May-20	February-21		276.00
5	**UTES Webinars Hosted on www.WBDG.org with targeted learning credits**	**September-18**	**October-20**		761.00
5.1	Webinar #1	September-18	May-19		242.00
5.2	Webinar #2	June-19	October-19		122.00
5.3	Webinar #3	November-19	April-20		152.00
5.4	Webinar#4	June-20	October-20		122.00
6	**Environmental & Technical (E&T) Guidelines for UTES Implementation**	**April-19**	**February-21**		672.00
6.1	Draft Version of E&T Guidelines for UTES	April-19	June-19		61.00
6.2	Intermediate Version of E&T Guidelines	April-19	June-20		427.00
6.3	Final Version of E&T Guidelines	July-20	February-21		215.00
6.2	Intermediate Version of E&T Guidelines	April-19	June-20		427.00
7	**Update to the WBDG**	July-20	February-21		215.00
7.1	Comprehensive Update to the WBDG	July-20	February-21		215.00
8	**Final Report & Outbrief**	**May-21**	**June-21**		31.00
8.1	Draft Final Report	**February-21**	March-21		28.00
8.2	Final Report (incorporating all ESTCP comments from the draft version)	May-21	June-21		31.00

Table 3 Schedule

9.0 MANAGEMENT AND STAFFING

The project will be managed by the following AH&P Team Members:

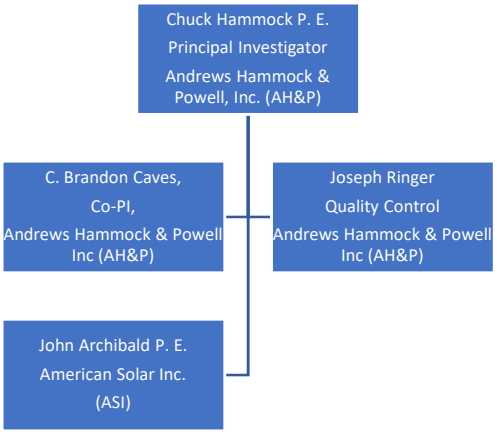

Figure 5 Organization Chart

Chuck Hammock P.E, Vice President of Andrews Hammock & Powell Inc, Principal investigator
Mr. Hammock will be responsible for all elements of the project, including:

- Interface with the ESTCP program
- Interface with NIBS/WBDG
- Develop supporting materials and training presentations and surveys
- reporting
- overall project financial management

C. Brandon Caves, Andrews hammock & Powell Inc
Mr. Caves will be responsible for day to day project responsibilities including:

- Scheduling of Tasks
- Website Coordination and Content
- Reporting
- SEMS Related Tasks
- Coordination of Seminars and Webinars

Joseph Ringer, Andrews Hammock & Powell Inc.
Mr. Ringer will be responsible for tasks related to:

- Coordination of UTES Evaluation Software Upgrades
- Environmental and Technical Guidelines
- Coordination and Content for Quarterly Newsletters and Fact Sheets
- Updating the Whole Building Design Guide
- Coordination of Video Production
- Coordination of Webinars, Videos, and Educational Material Design

John Archibald, President American Solar Inc
Mr. Archibald, Collaborating PI on ESTCP tech transfer project EW18-5300 will coordinate with Mr. Hammock to maintain consistent ESTCP program and NIBS website form and formats.

10.0 REFERENCES *Not Applicable*

APPENDICES

Appendix A: Points of Contact

POINT OF CONTACT Name	ORGANIZATION Name Address	Phone Fax E-mail	Role in Project
Chuck Hammock P.E.	Andrews Hammock & Powell Inc 250 Charter Lane Macon, Georgia 31210	Phone: (478) 405-8301 Direct: (478) 832-6362 chammock@ahpengr.com	Principal Investigator (PI)
C. Brandon Caves	Andrews Hammock & Powell Inc 250 Charter Lane Macon, Georgia 31210	Phone: (478) 405-8301 Direct: (478) 832-6384 bcaves@ahpengr.com	Co-PI
Joseph Ringer	Andrews Hammock & Powell Inc 250 Charter Lane Macon, Georgia 31210	Phone: (478) 405-8301 Direct: (478) 832-6375 bcaves@ahpengr.com	Quality Control
John Archibald	American Solar, Inc. 8703 Chippendale Court Annandale, Virginia 22003	Phone: (703) 425-0923 Cell: (703) 346-6053 JArchibald@americansolar.com	Collaborating PI on ESTCP tech transfer project EW18-5300