Proposal to Evaluate Renewable Sources to Power MDT-Owned Buildings and Facilities

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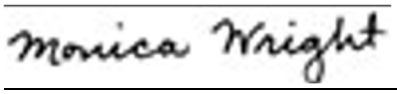

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EXECUTIVE SUMMARY

The Montana Department of Transportation is seeking to evaluate and integrate renewable energy sources to power its diverse portfolio of buildings and facilities. In light of rising energy costs and the urgent need for sustainable solutions, MDT aims to offset energy consumption through investments in renewable energy, thereby enhancing operational efficiency and reducing costs. Tetra Tech, Inc., in collaboration with Glumac, proposes a comprehensive study to assess the feasibility and cost-effectiveness of various renewable energy options, including solar photovoltaic (PV) systems, wind turbines, battery energy storage systems (BESS), and HVAC electrification retrofits.

This proposal outlines a structured approach to evaluate renewable energy potential across MDT facilities, which include office buildings, maintenance yards, and rest areas, each with unique energy demands and operational characteristics. Our extensive experience in renewable energy assessment positions us to deliver actionable insights and detailed analyses that will inform MDT's strategic investments in energy efficiency and sustainability.
Key objectives of the study include:

1. **Assessing Renewable Energy Potential**: Evaluating various renewable energy sources to meet MDT's energy and resilience needs.
2. **Conducting Financial Analysis**: Performing comprehensive financial assessments, including lifecycle costs and potential funding opportunities, to identify economically viable solutions.
3. **Determining Optimal Solutions**: Ranking renewable energy options based on lifecycle costs, resiliency, and other relevant factors.
4. **Designing Pilot Projects**: Developing detailed designs for pilot renewable energy systems at selected MDT facilities.
5. **Enhancing Resilience**: Evaluating hybrid systems and battery storage options to ensure continuous operation during power outages.
6. **Providing Subject Matter Expertise**: Offering expert guidance on renewable energy development and implementation.

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he anticipated benefits of this initiative include significant cost savings for MDT, increased operational efficiency, and enhanced environmental sustainability. By transitioning to renewable energy, MDT can reduce reliance on traditional energy sources, lower operational costs, and contribute to cleaner air and improved public health.

Our research plan is divided into four phases: Project Management, Energy Analysis, Implementation Plan, and Pilot Project Design. Each phase includes specific tasks and deliverables, ensuring a structured approach to achieving project objectives while maintaining stakeholder engagement and collaboration.

In conclusion, this proposal represents a strategic initiative for MDT to embrace renewable energy solutions, aligning with state objectives for environmental stewardship and economic resilience. By leveraging Tetra Tech's expertise, MDT can enhance its operational efficiency, reduce environmental impact, and improve service quality for the communities it serves.

PROJECT BACKGROUND AND PROBLEM STATEMENT

The Montana Department of Transportation (MDT) is faced with the challenge of evaluating and integrating renewable energy sources to power its diverse portfolio of buildings and facilities. With the rising costs of energy and the increasing need for sustainable and resilient energy solutions, MDT seeks to offset its energy consumption through renewable energy investments, enhancing efficiency while reducing operational costs.

Tetra Tech, Inc. (Tetra Tech) understands that MDT's primary goal is to assess the feasibility and cost-effectiveness of various renewable energy options, including solar photovoltaic (PV) systems, wind turbines, battery energy storage systems (BESS), and heating ventilation and air conditioning (HVAC) electrification retrofits. These evaluations will cover a range of facilities, from office buildings to maintenance yards and rest areas, each with unique energy demands, regional fuel availability, and operational characteristics.

Glumac, a Tetra Tech company, is a global building design consulting firm focused on creating sustainable, resilient buildings that provide healthy, productive, and equitable spaces for all communities. This focus on sustainable design and development has led to partnerships with various government and private organizations, including municipalities and higher education clients, in order to audit and design building improvements that focus on building energy efficiency, solar PV, clean energy microgrids, and fleet electrification.

Our extensive experience in renewable energy assessment and implementation equips us to address the complexities of this project. We recognize the importance of not only identifying viable renewable energy solutions but also providing a comprehensive financial analysis that includes lifecycle costs, potential grant funding, and federal/state/local incentive programs. By leveraging historical energy data and current/projected utility rates, we aim to deliver a comprehensive evaluation that supports MDT's decision-making process.

Furthermore, we acknowledge the need for systems that enhance the resilience of MDT's operations, especially during temporary power outages. MDT facilities must meet use requirements uncommon to other state agencies and are relied upon in occurrences of utility outages. Maintenance facilities are necessary to meet the needs of MDT personnel and rest areas are intended to provide refuge for travelers during times of inclement weather. Our approach will consider hybrid systems and battery storage options to ensure continuous power supply in emergencies. We also recognize the significance of exploring financial mechanisms such as power purchase agreements (PPAs) and energy savings performance contracts (ESPCs) to optimize the economic benefits of the proposed renewable systems to MDT.

In summary, we are committed to providing MDT with actionable insights and detailed analyses that will inform strategic investments in renewable energy. Our goal is to support MDT in achieving its energy efficiency and sustainability objectives while ensuring economic viability and operational resilience, with a custom approach that fits the financial and operational capabilities of the Department.

PRELIMINARY LITEREATURE REVIEW

A preliminary literature search was conducted utilizing the Transportation Research International Documentation (TRID) and Research in Progress (RIP) databases to gather relevant studies and reports on renewable energy applications in state-owned facilities, energy efficiency measures, and the economic viability of renewable energy technologies. The findings from this literature review highlight key trends and insights that inform the proposed study for MDT.

Renewable Energy Integration: The TRID database emphasizes the benefits of integrating renewable energy sources such as PV systems, wind turbines, and BESS into building energy management. Research indicates that these integrations can significantly reduce energy costs and improve energy efficiency. For example, studies have shown that PV systems can offset a substantial portion of a building's energy consumption, leading to long-term cost savings and reduced reliance on traditional energy sources (U.S. DOE, 2021).[1]

Economic Viability: Research indicates that the economic viability of renewable energy systems is influenced by factors such as initial investment costs, available grants and rebates, lifecycle operational costs, and return on investment. Financial analyses often include considerations of federal and state incentives, which can significantly enhance the cost-effectiveness of renewable energy projects. Studies demonstrate that with proper financial planning, renewable energy systems can provide a favorable return on investment over their operational lifespan (U.S. DOE, 2020).[2]

Energy Resiliency: The literature highlights that renewable energy systems can enhance energy resiliency, ensuring continuous operation during power outages and emergencies. Hybrid systems that combine renewable energy with battery storage are particularly effective in maintaining energy supply during such events. This capability is crucial for MDT facilities, which must remain operational during emergencies to provide essential services (U.S. DOE, 2021).[3]

Innovative Technologies: The RIP database reveals ongoing research projects that explore innovative renewable energy technologies and their applications in various building types. These projects aim to identify the most effective technologies for specific use cases, such as integrating advanced PV systems and wind turbines with existing building infrastructure. This research is particularly relevant for MDT as it seeks to implement cutting-edge renewable energy solutions (ENERGY STAR, 2021).[4]

Energy Efficiency Measures: Ongoing studies focus on improving energy efficiency through HVAC electrification retrofits, geothermal systems, and other efficiency measures. These measures are crucial for reducing overall energy consumption and enhancing the performance of renewable energy systems. For instance, retrofitting HVAC systems with energy-efficient technologies can significantly reduce energy usage and improve the overall sustainability of MDT buildings (ENERGY STAR, 2021).[4]

The findings from this literature review provide a solid foundation for the proposed study, demonstrating that MDT can build upon existing research to evaluate and implement renewable energy solutions tailored to its specific facilities and energy demands. By leveraging these insights, the proposed research aims to deliver actionable recommendations that enhance MDT's operational efficiency, sustainability, and resilience.

[1] U.S. Department of Energy (U.S. DOE). (2021). *Renewables Integration | Better Buildings Initiative*
[2] U.S. DOE (2020). *Building Energy Data*
[3] U.S. DOE (2021). *Buildings Performance Database Overview*
[4] ENERGY STAR. (2021). *Commercial Buildings and Onsite Renewable Energy*

SCOPE AND OBJECTIVES

The primary objective of this study is to evaluate the feasibility and cost-effectiveness of renewable energy sources to power MDT-owned buildings and facilities. This evaluation aims to identify viable renewable energy solutions that can offset MDT's energy use, reduce operational costs, and enhance energy efficiency and resilience.

Specifically, the objectives are:

1. **Assess Renewable Energy Potential:** Evaluate the potential of various renewable energy sources, including solar PV systems, wind turbines, BESS, HVAC electrification retrofits, and other innovative renewable technologies, to meet the energy and resilience needs of MDT facilities.
2. **Conduct Financial Analysis:** Perform comprehensive financial analyses, including lifecycle cost assessments, return on investment evaluations, and identification of potential grants and rebate programs. This will help determine the most economically viable renewable energy solutions.
3. **Determine Optimal Solutions:** Identify the renewable energy solutions with the highest likelihood of success for MDT facilities. Rank all considered options based on lifecycle costs, economics, resiliency, and other relevant factors.
4. **Design Pilot Projects:** Develop detailed designs for pilot renewable energy systems for selected MDT facilities. These designs will serve as models for future implementations and include considerations for both exporting and non-exporting system designs.
5. **Enhance Resilience:** Evaluate and recommend hybrid systems and battery storage options to ensure continuous operation of MDT facilities during power outages and other emergencies.
6. **Provide Subject Matter Expertise:** Offer expert guidance on renewable energy development and implementation to ensure the successful execution of the proposed solutions.

The expected products of this research include:

1. A comprehensive evaluation report detailing the feasibility and cost-effectiveness of renewable energy sources for MDT-owned buildings and facilities.
2. Financial analysis reports that include lifecycle costs, potential savings, and return on investment for each renewable energy option.
3. Detailed designs and specifications for pilot renewable energy systems for selected MDT facilities.
4. Recommendations for enhancing the resilience of MDT facilities through hybrid systems and battery storage solutions.
5. Expert guidance and best practices for implementing renewable energy projects within MDT.

By achieving these objectives, the study aims to provide MDT with actionable insights and practical solutions for transitioning to renewable energy, ultimately leading to cost savings, improved efficiency, and enhanced sustainability.

BENEFITS AND BUSINESS CASE

Advances in renewable energy technologies and the significant decrease in associated costs have made renewable energy a more economically viable and resilient option for large-scale implementation. Additionally, the Inflation Reduction Act (IRA) has updated clean electricity tax credits to now include tax-exempt entities as eligible recipients. This provision allows MDT to leverage financial incentives through a direct payment reimbursement option, presenting even more favorable opportunity for cost savings.

Our proposed research to evaluate renewable energy sources for MDT-owned buildings and facilities is a strategic initiative aimed at transforming MDT's energy consumption practices. This project addresses the pressing need for cost-effective and sustainable energy solutions and aligns with state objectives for environmental stewardship and economic resilience. By exploring and implementing renewable energy options, MDT has the potential to significantly enhance its operational efficiency, reduce environmental impact, and improve service quality. The following sections outline the key benefits and the business case for undertaking this research and potentially implementing the results.

BENEFITS

1. Cost Savings

MDT Cost Savings: Investing in renewable energy sources can reduce MDT's reliance on external energy providers, leading to ongoing operational cost savings. This shift will result in long-term savings as the initial investment in renewable technology pays off through reduced utility expenses over time. Various investment opportunities are available to assist with the initial capital cost of implementing projects. These will be evaluated within the research project.

Public Cost Savings: Reduced operational costs for MDT can lead to lower public expenditures. Savings from energy bills can be redirected to other critical areas, such as road maintenance, public transportation enhancements, and community projects. This efficient use of public funds can provide greater value to taxpayers and improve overall public welfare.

2. Economic Development

Increased Technical Services: The installation, maintenance, and operation of renewable energy systems will increase the demand for local engineering, construction, and technical services. Local engineering, design, and construction firms have long-standing relationships with the State of Montana and complete various engineering, procurement, and construction projects through the Department of Transportation and Department of Administration's Architecture and Engineering (A&E) Division. This increase in demand will contribute to the local economy and provide opportunities for skilled workers in the community.

3. Efficiency Gains:

Energy Efficiency: Installing technologies such as heat pumps, renewable power generation, and BESS can optimize energy consumption in MDT buildings. These systems are more efficient than traditional and

vintaged versions. Upgrading can help reduce energy waste and improve overall energy management. Energy efficiency requires insight into building materials and construction design. This research project would identify opportunities where existing conditions are advantageous for pairing electrification with on-site renewable energy.

Operational Efficiency: Modern energy management systems can allow for automated monitoring and control of energy use, reducing the need for manual interventions. This automation can streamline operations, minimize errors, and enhance the overall efficiency of facility management.

4. Environmental Gains:

Sustainable Practices: Transitioning to renewable energy sources will lower pollutant emissions associated with traditional power generation sources. This reduction can contribute to cleaner air, improved public health, and a positive impact on the environment. MDT can set an example for other agencies and demonstrate a commitment to environmental responsibility and sustainable development.

5. Improved Infrastructure:

Modernization: Upgrading facilities with renewable energy technologies will modernize MDT's infrastructure, making it more resilient to future energy challenges. Proper planning aligned with this modernization can ensure that MDT facilities are equipped to handle the evolving energy landscape.

Increased Lifespan: Renewable energy systems typically have long lifespans and low maintenance costs. These attributes will extend the functional life of MDT facilities and reduce the frequency and cost of repairs and replacements. For example, Tetra Tech generally evaluates Solar PV projects with a 25-year lifespan and a degradation of 0.5% in efficiency per year. Additionally, once infrastructure is in place from an initial project, the cost to replace an existing, outdated system is about 60% of the cost to install a brand-new system.

6. Improved Procedures and Processes:

Data-Driven Decision Making: Utilizing historical data and analytics for energy usage and cost assessments will enable MDT to make more informed and strategic decisions. This data-driven approach will improve planning and implementation of energy projects.

Standardization: Establishing best practices for renewable energy implementation will standardize procedures across all MDT facilities. This standardization will lead to more consistent and reliable outcomes, ensuring that all facilities benefit equally from energy efficiency improvements, and where possible bulk purchasing across multiple facilities can result in lower individual material costs.

7. Improved Quality and Service:

Reliable Energy Supply: Renewable energy systems, especially those with BESS, can provide a more reliable and stable energy supply. This reliability will reduce the risk of power outages and ensure continuous operation of critical facilities.

8. Increased Safety:

Emergency Preparedness: Renewable energy systems with BESS can ensure continuous operation of critical facilities during power outages, enhancing safety and resilience in emergency situations. This capability will be crucial for maintaining essential services during natural disasters or grid failures.

BUSINESS CASE

The need for this research arises from the increasing energy costs of utility tariffs and environmental challenges associated with traditional energy sources. As MDT prepares for the future, this project can play a necessary role in transitioning to more sustainable and cost-effective energy solutions. The business case for this research includes the following key points:

1. **Energy Portfolio Diversification**: Without intervention, MDT will continue to face increasing energy costs associated with traditional energy providers. New construction projects present a significant opportunity for long-term development and asset management. By diversifying their energy portfolio to include renewable sources, MDT can better adapt to the evolving energy landscape and reduce the risks associated with relying solely on traditional energy delivery systems. This diversification is crucial to avoid being constrained by the limitations and vulnerabilities of historical approaches to energy management.
2. **Asset Risk Management:** Failing to diversify energy resources now could expose MDT to the risk of assets that do not fully achieve their intended return on investment. The economic lifecycle of energy investments is important; infrastructure designed to last for decades may face challenges if it continues to rely solely on traditional energy sources. Proactively integrating renewable energy solutions will help mitigate these financial and operational risks, ensuring that MDT's infrastructure remains viable, resilient, and cost-effective over the long term. By embracing diversification now, MDT can better position its investments for future success, optimize asset utilization, and reduce the potential for underperforming assets.
3. **Real World Costs**: Current energy expenditures for MDT facilities represent a significant portion of operational costs. With anticipated increases in energy prices, these costs will continue to rise, placing a financial strain on MDT’s budget and resources.
4. **Monetary and Time Savings**: Implementing the recommendations from this research can lead to substantial savings in energy costs and operational efficiencies. These savings can be reallocated to other critical areas, improving overall service delivery and infrastructure development.
5. **Improvements in Safety, Efficiency, and Services**: The adoption of renewable energy technologies will enhance the safety and reliability of energy supply, improve the efficiency of building operations, and provide higher quality services to the public.
6. **Timeliness**: The research is timely as it aligns federal initiatives and financial incentives promoting renewable energy and grid resiliency. Completing the research before major policy or infrastructure changes will ensure MDT can capitalize on available incentives and grants implemented through the federal Bipartisan Infrastructure Law and Inflation Reduction Act.
7. **Beneficiaries**: The primary beneficiaries of this research will be MDT, its employees, and the public. MDT will benefit from reduced energy costs and improved infrastructure, while the public will enjoy enhanced transportation services and a cleaner environment.

8. **Departmental Impact**: The research will directly impact multiple departments within MDT. These departments can use the research findings to implement and manage renewable energy projects, leading to a more sustainable and efficient organization. Projects specific to rest areas can be potentially implemented at scale, providing renewable energy systems to rest areas beyond those listed in the research project.

By conducting this research, MDT aims to pave the way for a sustainable and resilient energy future, achieving significant cost savings, environmental benefits, and operational efficiencies that will benefit both the organization and the public it serves.

RESEARCH PLAN: PROPOSED PHASES AND TASKS

The successful execution of this research project relies on a structured and methodical approach, encompassing a series of well-defined tasks aimed at achieving the project objectives. Our research plan is designed to provide a comprehensive evaluation of renewable energy sources for MDT-owned buildings and facilities, culminating in the design and implementation of pilot projects. This plan will leverage Tetra Tech's extensive experience in renewable energy projects, detailed data analysis, and stakeholder collaboration.

Our approach will ensure the project remains on schedule, within budget, and meets all specified goals. The research plan is divided into distinct phases, each addressing specific tasks and deliverables outlined in the RFP. These phases include project management, initial project kickoff, detailed energy analysis, and the development of an implementation plan, followed by the design of pilot projects.

PHASE 0: PROJECT MANAGEMENT

Tetra Tech will leverage its significant project management experience to run the project efficiently and effectively, including the following notes on frequency and type of meetings. These can be more fully explored during a kickoff meeting and are open to review and feedback from the MDT stakeholders to identify areas that warrant additional focus.

1. Tetra Tech will host biweekly virtual meetings with relevant stakeholders and send out an agenda and expected list of attendees prior to each meeting with ample time for review
2. Tetra Tech will record, consolidate, and send out meeting minutes with action items for each meeting
3. Tetra Tech will host larger presentations and progress update meetings at the end of each phase of the project

PHASE 1: PROJECT KICKOFF & DELIVERY

Objective: Finalize the project work plan, including a schedule and critical path scope. Define project goals, outcomes, and key performance indicators (KPIs).

1A) KICKOFF MEETING and PROJECT WORKPLAN

Tetra Tech will host a project kick-off meeting with key project stakeholders to review the draft renewable energy study and discuss other critical items.

1. Review project goals, background information, past renewable energy studies, and other MDT planning documents.
2. Define the MDT's Key Performance Indicators (KPIs), such as life cycle net present value (NPV) and energy consumption offsets.
3. Review and discuss resilience requirements for each facility and its critical operations (E.g., hours the facility should be able to operate during a grid outage).
4. Review data collection needs and develop a plan to minimize the impact on MDT employees.

Additionally, Tetra Tech will work closely with the MDT to create a project work plan, including a schedule of key milestones, deliverables, and associated meetings. We will also identify critical path items and key timelines for staying on schedule.

Establishing a clear work plan is critical to ensuring goals and expectations are met while maintaining the project schedule. Tetra Tech welcomes the MDT's feedback and collaboration during this phase.

1B) BACKGROUND RESEARCH:

Tetra Tech will conduct general background research and inform the project team of critical considerations for the MDT's Renewable Energy study. Research topics may include:

1. Regulations & Codes – federal, state, local, and other relevant regulations and codes
2. Utility Rate Tariffs – current and projected electrical and natural gas rates
3. Funding & Financing – existing funding streams and potential new sources
4. Grants & Incentives – IRA/IIJA (ex. Investment Tax Credit), utility incentives, etc.
5. Asset Management – review of internal asset renewal and maintenance practices

1C) DATA COLLECTION:

Tetra Tech will collect and consolidate relevant historical information. Collecting data can be a time-consuming effort and is a potential area of concern for maintaining the schedule. To mitigate this risk, Tetra Tech has developed a data collection process that alleviates some of the challenges and minimizes the impact on capital planning and facilities management groups. We schedule data request meetings early in the project, establish file-sharing protocols on preferred platforms, and provide a tracking tool to monitor the collected data. Our preliminary list of information requests includes the following:

1. As-built drawings for the scoped buildings and associated electrical infrastructure
2. Previous engineering feasibility studies, energy modeling reports, or facility condition assessments
3. List of existing HVAC equipment's make, model, capacity, and location
4. List of existing or planned renewable energy project's capacity, type, and location
5. Utility and submeter energy data (electricity and natural gas) from the State Buildings Energy Conservation Program database
6. Compiled critical requirements list per facility

If remote access is available, Tetra Tech will request it to streamline the data collection process from the MDT's building automation system (BAS), energy management systems (EMS), and any other building data platforms.

PHASE 2: ENERGY ANALYSIS

Objective: Establish a clear understanding of the existing facility's energy and utility infrastructure systems. Document baseline existing conditions and energy performance and identify unique conditions. Identify potential energy technologies and conceptual system options to increase the presence of renewable energy systems at Montana Department of Transportation facilities.

2A) BUILDING, INFRASTRUCTURE, AND UTILITY REVIEW:

The existing conditions review will involve interviews and evaluation of existing engineering documents so that Tetra Tech can provide a comprehensive review of each building's existing systems and operational efficiency. Tetra Tech will evaluate each building's electrical and heating energy consumption to identify areas that require focus in the following phases. This information will be used for this phase's final deliverable.

1. Interviews with Area office managers and the MDT Facilities Bureau to understand programmatic operational and maintenance requirements that align with MDT's long-range building and facility repair and maintenance program. Interviews with individual on-site facility managers to quantify operational expectations during power outages and building-specific concerns for renewable energy technologies, such as available space and other physical constraints.
2. Verify existing systems using provided As-Built drawings
3. Provide a building database with key information and building summaries containing each facility's usage, condition, size, and unique considerations.
4. Confirm the reliability of the electrical utility infrastructure by reviewing utility drawings and interviewing facility staff regarding historical utility outages.
5. Develop an understanding of historical outage frequency and duration and potential future risks.

2B) BUILDING ENERGY AND OPERATIONAL ASSESSMENT:

Tetra Tech will evaluate each facility's historical energy consumption and create a database benchmarking each facility's operational performance. The results will be included in this phase's final deliverable and used in future stages to size the various renewable energy power options.

1. Utilize the provided utility bill data to establish baseline energy performance at each facility
2. Use engineering analysis, building benchmarking databases, and previous project experience to estimate the different categories of energy consumption associated with each building to highlight areas of opportunity for energy offsets
3. Rank each facility's energy efficiency within the portfolio of buildings analyzed as well as against national averages for buildings of comparable type, size, and located in similar climates

2C) RENEWABLE ENERGY TECHNOLOGY REVIEW:

Tetra Tech will evaluate various renewable energy backup power technologies to transition the MDT's power generation sources to cheaper and cleaner alternatives. Tetra Tech will build upon existing research and resources and provide specific considerations for each facility. This assessment will include:

1. Develop a technology summary matrix with key information about each distributed energy resource (DER) technology. This will include but is not limited to the following:
    - Solar PV - Rooftop, Carport and Ground Mounted
    - Battery Energy Storage System (BESS)
    - Generators – Linear, Diesel, Natural Gas
    - Microgrid Controls
    - Wind Turbines

- Air and ground source heat pumps
- Geothermal energy
- Fuel Cells

2. Provide brief technology summaries, general system schematics, performance data, resilience considerations, technology readiness, design considerations, operations & maintenance impacts, retrofit applications, and other relevant information.
3. Provide preliminary rough order of magnitude costs.
4. Rank potential technologies and review with MDT stakeholders for feedback.

2D) PERMITTING AND ENVIRONMENTAL CONSIDERATIONS:

Tetra Tech will review environmental and permitting requirements and identify key considerations. We recognize that it is crucial to identify any constraints early, and therefore, the permitting process will be prioritized during this phase. These constraints would likely focus on net metering regulations, environmental concerns, and any rules on exporting limitations.

Tetra Tech will provide early considerations for any permitting and environmental requirements that the MDT should be aware of when evaluating technology types and then build upon these considerations to develop permitting strategies in the final phase.

PHASE 3: IMPLEMENTATION PLAN

Objective: Assess strategies needed to upgrade existing facility power generation and operational resilience based on technical engineering, modeling, and financial considerations. Develop a final report of recommendations to be used by MDT for future project planning.

3A) BACKUP POWER AND RESILIENCE ENERGY MODELING:

Tetra Tech will incorporate the information from the baseline assessment phase and calculate the anticipated electrical and heating loads at each facility. This review will involve estimating any future growth considerations that will increase electrical demand, such as facility expansions, building electrification, or installing EV charging ports. Tetra Tech understands there is no official MDT policy for a future transition to an EV fleet, so these future load projections will act as guiding considerations rather than strict forecasted estimates.

Next, Tetra Tech will perform backup power and resilience energy modeling using relevant software such as Xendee, ReOpt, and Helioscope to optimize the capacity and type of backup power systems. The modeling will analyze up to three backup power configurations per site and provide the following metrics:

1. Hybrid PV/Battery (or other renewable energy generation sources) configuration to provide optimally sized backup power needs to meet operational resilience requirements
2. Estimated electrical offset for each facility in both total annual consumption (kWh) and peak demand (kW)
3. Estimated utility bill offset using applicable rate structures from the local utility accounting for time-of-use, peak shaving, and demand reduction charges

4. The optimal location for renewable energy systems, whether in front of or behind the meter, pending review of local utility regulations
5. Provide control strategies that will allow for the facility's islandable (resilient) operation when the local utility loses power. These will be compared to a non-islandable control configuration to highlight the additional costs and equipment needed to operate the renewable energy generation systems during an outage.
6. Provide high-level implementation considerations around the existing facility's electrical capacity and configuration for adding new energy generation systems. This includes required or recommended upgrades that would be associated with installing new EV chargers at any of the MDT maintenance yards and how to optimally pair the new chargers with relevant renewable energy generation and storage systems.

3B) COST ESTIMATING:

Tetra Tech will provide rough order of magnitude (ROM) cost estimates for system options. Providing early costing feedback is critical for the success of facility upgrade planning efforts. Tetra Tech will support the MDT in distributing potential costs and operations impacts early to MDT leadership and ensuring buy-in at a high level before moving into stakeholder engagement.

1. Develop a cost-estimating memo with assumptions for pricing typical renewable energy power systems, technologies, and infrastructure. Montana Department of Transportation to review estimating memo.
2. Establish a standard for contractor markups, internal MDT cost markups, and contingency.
3. Provide cost estimates. Up to one round of review comments are to be included.
4. Establish scalable unit costs for renewable energy technologies (ex. $/kWh, $/kW), infrastructure upgrades (ex. $/foot of distribution, electrical), and other potential cost impacts (ex. landscaping, sound attenuation)

3C) LIFE CYCLE COST ANALYSIS:

Tetra Tech will provide a preliminary life-cycle cost analysis (LCCA) to evaluate the financial impact of renewable energy options. We will establish a LCCA framework to deliver results in a memo that will become a section of the final report.

1. Establish an LCCA framework, including requirements and assumptions for construction costs, utilities, operations & maintenance, utility bill savings, and other financial metrics, such as funding sources, to be confirmed with relevant stakeholders. The LCCA will be completed for each technology type and as a resilient vs non-resilient scenario to show the increased cost of additional microgrid controls required for islanding capabilities.
2. Assess renewable energy strategies and provide a sensitivity analysis (ex. construction cost contingency, utility escalation, cost of carbon).

3D) FUNDING AND REVIEW:

Tetra Tech will provide a funding and financing review to assess potential opportunities available to the MDT:

1. Document existing infrastructure, including conditions, deficiencies, and opportunities.
2. Identify critical near-term projects and long-term strategies for transitioning to renewable energy power generation.
3. The final report will include funding options for each facility, such as entering a power purchase agreement, purchasing offsite green energy through the local utility, or an energy savings performance contract

Based on the results from Phase 3, Tetra Tech will provide a report of final recommendations. These will be included in the final deliverable and will contain the following:

1. Estimated installation cost, utility bill and carbon emission reductions, and generation capacity per system and site
2. Resilience requirements and anticipated operational capabilities during an outage per facility
3. Rough implementation timeline that involves phasing out or incorporating existing generators at the end of, or during their remaining, expected operational life
4. Provide a final draft for MDT stakeholder review.
5. Provide a final draft based on comments and feedback.
6. Develop additional reporting materials, including an executive summary for MDT leadership (1-2 pages) and a final presentation.

PHASE 4: PILOT PROJECT DESIGN

Objective: Develop two high-level PV designs for future use by MDT at existing facilities. Neither design will require engineering stamps. Evaluate funding and implementation options available to MDT, such as a PPA or ESPC, and provide a final recommendation.

4A) Pilot PV Design

Tetra Tech will provide a high-level PV pilot design intended to be used as a replicable template across multiple similar office and maintenance building rooftop sites. The design will have enough detail to create a relatively accurate price estimate for the project for future contractors engaged in implementing the design. In addition to the non-stamped design, the analysis will include implementation, economic, and electrical design considerations.

1. Conceptual single-line diagram of the electrical infrastructure needed to tie in the PV system

2. Conceptual site plans showing location of the PV system and major electrical equipment & electrical distribution

3. Project narrative including a project summary, performance requirements, basis of design, and summary of any needed electrical infrastructure upgrades to integrate a new PV system

4. Costing memo with preliminary pricing, including construction costs and markups

5. Economic analysis of components that would contribute to a comprehensive cost package to install a new PV system, including capital and maintenance costs, construction markups, utility cost offsets, and estimated life-cycle prices. This economic analysis will incorporate available incentives, subsidies, and rebates to reflect installation costs accurately. This will be similar to the deliverables from 3C but specific to the PV systems designed in Phase 4.

    a. Considerations will be limited to high-level notes, and other specialty consultants (geotechnical, structural, etc.) will not be included in this proposal.

4B) Helena HQ PV Design

Tetra Tech will provide a high-level PV design specific to MDT Helena HQ. The PV system will be sized to meet the facility's electrical load without exceeding it and include consideration of net metering and exporting agreements with the utility.

The design will not be stamped but will have similar detail and considerations as the pilot design from 4A.

4C) Delivery Methods

Evaluate the potential for installing the renewable systems using either a PPA or ESPC. This feasibility analysis will lead to a final recommendation on the route MDT should take and will include distance from site, available land area, interconnection to existing electrical infrastructure, and contract pricing terms.

DATA REQUIREMENTS AND STAKEHOLDER INVOLVEMENT

The successful execution of this research project will require collaboration and support from MDT, the designated Technical Panel, and other State Agencies. This section outlines the specific types of assistance and involvement needed from MDT and stakeholders, including the timeframe for each activity.

- **Stakeholder Interviews:** Coordination of interviews with area office managers, the MDT Facilities Bureau, and individual on-site facility managers to understand programmatic and operational requirements. These interviews will take place during the building, infrastructure, and utility review in Phase 2.
- **Critical Requirements List:** Compilation of critical operational requirements for each facility, including resiliency needs during power outages. This information is crucial for the energy analysis phase and should be provided early in Phase 2.
- **Technical Panel Meetings:** Regular meetings with the Technical Panel to review project progress, discuss findings, and gather feedback. These meetings will occur biweekly as part of the ongoing project management activities, and additional meetings will be scheduled at key project milestones, such as the end of each phase.
- **Draft Deliverables:** Review and feedback from MDT staff and the Technical Panel on draft deliverables, including the Interim Task Report, the final report, and any pilot project designs. This will ensure the final products meet MDT's needs and expectations. Feedback periods will be incorporated into the project schedule, particularly at the end of Phase 2 and Phase 3.
- **Final Presentation and Implementation Meeting:** Participation in the final project presentation and the implementation meeting to discuss findings, recommendations, and potential next steps. These meetings will be scheduled at the end of Phase 3 and Phase 4.
- **Data Entry and Management:** Support for entering and managing data obtained from hard copy sources, ensuring it is accurately digitized and available for analysis. This task will be ongoing throughout the data collection process in Phase 1.
- **Historical Energy Data [Available through the Montana Energy Bureau or MDT]:** Provide historical energy consumption data that is maintained within the Montana Energy Bureau database. Additional data requests may be directed to MDT for data not maintained within the database, which may include delivered fuels, such as propane or fuel oil. This data will be required at the project kickoff and throughout the data analysis phase to ensure accurate assessments and modeling.
- **As-Built Drawings and Facility Plans [Available through the Montana Department of Administration A&E Division or MDT]:** Provision of as-built drawings, facility layouts, and any previous engineering feasibility studies, energy modeling reports, or condition assessments. These documents will be essential for the initial facility review and energy analysis, required at the start of Phase 1.
- **HVAC Equipment Information [Available through the Montana Department of Administration A&E Division or MDT]:** Lists of existing HVAC equipment, including make, model, capacity, and location, to be collected during the data collection phase in Phase 1. This information should be available through as-built drawings but will need to be supplemented or confirmed by facilities' maintenance staff.

By outlining the specific involvement and assistance required from MDT and the Technical Panel, we aim to ensure clear communication and efficient collaboration throughout the project to effectively achieve the project's objectives.

BUY AMERICA CONSIDERATIONS

There are no anticipated purchases of equipment, analytics, or components for the project. Should such items be required, Tetra Tech will confirm with MDT that procurement is permissible within the contract scope and will ensure compliance with "Buy America" requirements (23 CFR 635.410).

INTELLECTUAL PROPERTY

There are no anticipated intellectual property issues.

FACILITIES

No facilities are required to accomplish the research, and no specific equipment is necessary for completion of the research and specify any restrictions on its use.

STATE INVOLVEMENT AND STAKEHOLDERS

The successful execution of this project and the implementation of its findings require the collaboration and support of key individuals and organizations. These stakeholders will play crucial roles in providing pertinent technical and utility data. This will aid in the overall end-product. The following partners are identified as essential contributors to this project:

Montana Department of Transportation

Role: As the lead agency for this research project, MDT will play a pivotal role in facilitating the successful execution of the project. MDT's involvement will ensure that the research aligns with the agency's operational needs and strategic objectives, particularly in enhancing energy efficiency and resilience across its facilities. If awarded, Tetra Tech will partner with MDT to confirm an official workplan, schedule, meeting cadence, and communication pathways that best serves the project and MDT.

Responsibilities:

- Stakeholder Coordination: Assist in coordinating interviews with area office managers, the MDT Facilities Bureau, and individual on-site facility managers during the building, infrastructure, and utility review in Phase 2.
- Critical Requirements Compilation: Provide a compilation of critical operational requirements for each facility, including resiliency needs during power outages, to inform the energy analysis phase early in Phase 2.
- Technical Panel Engagement: Participate in regular meetings with the Technical Panel to review project progress, discuss findings, and provide feedback, occurring biweekly and at key project milestones.
- Review of Draft Deliverables: Provide feedback on draft deliverables, including the Interim Task Report and final report, ensuring alignment with MDT's needs and expectations.
- Final Presentation Participation: Participate in the final project presentation and implementation meeting to discuss findings and recommendations.
- Provision of Historical Energy Data and As-Built Drawings: Provide historical energy consumption data and ensure access to as-built drawings and facility layouts necessary for the analysis.
- Coordination with Other State Agencies: Facilitate communication and coordination with other relevant state agencies for data sharing and support.

Montana Energy Bureau

Role: The Montana Energy Bureau is responsible for maintaining a comprehensive utility database of all electricity and natural gas use for state buildings. Their involvement will be to provide historical energy data, which is fundamental for our analysis in benchmarking historical energy use at the selected buildings. Additionally, their State Buildings Energy Conservation Program (SBECP) implements efficiency and renewable energy projects at state buildings and can provide valuable insights through their familiarity with state building operations and past experience. This dual role will enhance our understanding of both historical energy consumption and the practical considerations for implementing new energy projects. Lastly, the Tetra Tech

project team will utilize the knowledgebase of the Energy Planning and Energy Efficiency & Compliance Assistance sections of the Energy Bureau for additional insights on the current and forecasted status of federal or state funding programs.

Responsibilities:

- Provide access to the utility database by responding to data requests from the research team.
- Retrieve detailed historical energy consumption data for requested MDT facilities.
- Collaborate in data verification processes to ensure accuracy and completeness of the utility data.
- Participate in content-specific meetings to offer insights and feedback on energy data analysis.
- Provide insight on efficiency and renewable energy project implementation from prior project experience with state buildings

Montana Department of Administration - Architecture and Engineering Division

Role: The Architecture and Engineering Division maintains all as-built drawing sets for state buildings, including mechanical, electrical, and plumbing (MEP) drawings. Their input will be critical for the accurate assessment of current building infrastructure and for the design of renewable energy systems.

Responsibilities:

- Provide access to as-built drawings and facility plans for the MDT buildings within the project scope.
- Assist in verifying the existing conditions and infrastructure of the buildings through documentation and potentially on-site evaluations.
- Engage in technical review meetings to provide feedback on the engineering aspects of proposed renewable energy systems.

Montana Department of Administration - General Services Division (as necessary)

Role: The General Services Division maintains buildings throughout the Helena Capitol region and will be involved as necessary, particularly if the project scope includes facilities under their management, and as necessitated by MDT.

Responsibilities (if applicable):

- Participate in discussions regarding maintenance and operational implications of renewable energy installations.

MEETINGS AND DELIVERABLES

All deliverables will be created to adhere to the MDT report writing requirements and will undergo Tetra Tech's quality control process. Each deliverable will be submitted as a draft with the opportunity for MDT to review and leave revisions before Tetra Tech provides a final deliverable incorporating the comments.

DELIVERABLE FORMAT AND SUBMISSION PROCESS:

The following outlines the specific requirements for the format and submission of all project deliverables, including the protocols for draft submissions, revisions, acceptance criteria, review cycles, and quality assurance measures. These procedures are essential for ensuring the standards expected by MDT are met and ensuring that all deliverables meet the agency's operational and strategic objectives.

Draft Submission

- All deliverables will be submitted initially in draft format, representing Tetra Tech's vision of the complete and final deliverables.

Revisions

- A second draft will be submitted within two weeks following receipt of MDT's comments on the first draft.
- All subsequent revisions will be submitted no later than one week following receipt of MDT's comments.
- A line-item response to each comment will be provided for every deliverable.

Final Acceptance

- Deliverables will be considered drafts until a Notice of Acceptance is received from MDT.

Review Cycles

- Tetra Tech will plan for three review and revision cycles for all deliverables, with each MDT review allotted one month.

Submission Formats

- All deliverables will be submitted in both Microsoft Word® and Adobe Acrobat®-compatible electronic formats.

Quality Assurance

- Deliverables will undergo a review by an additional team member and will be spell-checked prior to submission.

Data Presentation

- All data will be expressed in metric units, with English units provided in parentheses or accompanied by a conversion chart.

REQUIRED REPORTS

The following outlines the specific types of reports that will be generated, along with their submission timelines and content requirements. Each report is designed to capture critical information related to project tasks, financial expenditures, and overall progress, thereby supporting MDT's decision-making processes and strategic objectives.

Monthly Progress Reports will be submitted by the 15th of each month, offering a comprehensive overview of the project's status. Each report will detail the progress of major tasks outlined in the proposal, clearly

indicating whether they have been completed or are still in progress. Furthermore, the report will include a thorough review of the project schedule and budget, comparing actual performance against planned benchmarks to identify any variances. This will allow for proactive management of the project timeline and financial resources. Additionally, the report will outline the tasks that have been completed during the reporting period and provide a rough percentage of completion for each remaining task. By doing so, the Monthly Progress Report will ensure that all stakeholders are well-informed of the project's trajectory and any necessary adjustments to the plan.

Task Reports will be submitted by the end of the month following the completion of each task. These reports will be prepared with sufficient detail to allow for seamless compilation into the final report. Each Task Report will summarize the activities undertaken, the outcomes achieved, and any challenges encountered during the execution of the task. This level of detail will provide MDT with insights into the progress of specific components of the project and facilitate informed discussions during stakeholder meetings.

An **Interim Task Report** will be prepared to cover evaluations detailed in the project tasks. This report will serve as a checkpoint, summarizing findings and insights gained up to that point in the project. It will provide a synthesis of the data collected and analyses performed, allowing MDT to assess the direction of the project and make any necessary course corrections before proceeding to subsequent phases.

A **Blueprint Policy** will be developed after review of the Interim Task Report and discussion with Technical Panel. It will outline example high level designs listed under B-1 through B-3 to be included in the Final Report. The Final Report includes everything incorporated in the Interim Report, with the additional information regarding policy and pilot project design.

The **Final Report** will be a comprehensive document that encapsulates the entire project. It will include a title page, technical report documentation page, disclaimer, ADA alternative format statement, and a table of contents for easy navigation. The report will provide a summary of the project, an introduction to the objectives and scope, a detailed work plan, findings from the evaluations, implementation recommendations, and a comprehensive list of literature cited. This report will serve as a key resource for MDT, summarizing the project's outcomes and providing actionable recommendations for future initiatives.

A **Research Project Summary Report** will also be generated, providing a concise overview of the project. This report will summarize what was accomplished, the key findings, and the recommendations made throughout the research. It will be designed to be accessible to a wide range of users within MDT and other relevant stakeholders, ensuring that the insights gained from the project can be effectively communicated and utilized.

The I**mplementation Report** will focus on summarizing the recommendations and strategies for implementing the proposed renewable energy solutions. This report will detail the steps necessary for MDT to move forward with the implementation of the findings, addressing potential challenges and providing guidance on best practices to ensure successful execution.

Finally, a **Performance Measures Report** will be included, which will encompass both qualitative and quantitative performance measures. This report will assess the effectiveness of the implemented solutions, providing metrics that can be used to evaluate the success of the project and inform future decision-making.

FINAL PRESENTATION DELIVERABLES:

The **Final Oral Presentation** will be a formal event conducted to present the research findings to MDT employees and other interested stakeholders. This presentation will serve as a critical opportunity to communicate the outcomes of the project, highlighting key insights, recommendations, and the implications of the research. Tetra Tech will prepare a comprehensive presentation that summarizes the project's objectives, methodologies, findings, and proposed next steps. The presentation will be designed to engage the audience, facilitate discussion, and address any questions or concerns that may arise. This deliverable will be itemized as a direct cost in the proposal and will be deducted from the total project budget if the presentation is not conducted at MDT's discretion. By providing this presentation, Tetra Tech aims to ensure that all stakeholders are aligned on the project outcomes and are equipped to make informed decisions regarding the implementation of the recommendations.

In addition to the Final Oral Presentation, Tetra Tech will offer a **Project Webinar** to further disseminate the research findings and engage a broader audience. This webinar presentation may be combined with the Final Oral Presentation, allowing for a flexible format that accommodates participants who may not be able to attend in person. Tetra Tech will provide the necessary webinar facilities, ensuring a seamless and professional experience for all attendees. The webinar will include a detailed overview of the project, interactive discussions, and opportunities for participants to ask questions and provide feedback. This deliverable will also be itemized as a direct cost in the proposal, reinforcing Tetra Tech's commitment to effective communication and stakeholder engagement throughout the project.

PHASE-SPECIFIC DELIVERABLES:

Phase 1

The following deliverables will be provided for the "Project Kickoff and Delivery" phase

Kickoff Meeting Presentation

An introductory presentation summarizing the MDT Renewable Energy Study. Deliverables will include a PowerPoint presentation and PDF. MDT Facilities staff may leverage the presentation to engage with senior leadership and/or wider MDT stakeholders.

Project Workplan

Detailed project work plan document, including project management and data collection tracking tool. This will confirm meeting cadence and schedule along with methods of communication.

Phase 2

The following deliverables will be provided for the "Energy Analysis" phase

Building Database Spreadsheet

An Excel spreadsheet will be created to serve as a database for all buildings within the scope. The site, utility, infrastructure, and energy and operational analysis will be used to populate the database with information on energy consumption, size, typology, system type, and utility data.

Energy Analysis Presentation

Provide a baseline assessment presentation summarizing findings. Deliverables will include a memo and brief PowerPoint presentation providing an update on progress. The target audience includes the core MDT project team and associated leadership.

Renewable Power Technology Matrix

Tetra Tech will provide the technology summary matrix as a progress update and can present it in a meeting to review and receive feedback from MDT stakeholders.

Phase 4

The following deliverables will be provided for the "Pilot Project Design" phase

Pilot PV High-Level Engineering Design

Provide a conceptual solar PV design including high-level plans and project narratives that can be used for solicitation of a design-build solar PV contractor to implement the project.

Helena HQ PV High-Level Engineering Design

Provide a conceptual solar PV design including high-level plans and project narratives that can be used for solicitation of a design-build solar PV contractor to implement the project.

SCHEDULE

The following section provides a graphical presentation illustrating the scheduling of the major research tasks on a weekly basis. This detailed schedule includes all meetings and deliverables, specifying the timeframe for each submittal relative to the start of the project. The schedule ensures that all project activities are aligned with the approval process of the MDT Research Review Committee (RRC), which meets at most once a month. To align with funding approval timelines, the schedule indicates time by weeks rather than specific dates (i.e., week, 1, week 2, etc.). A final schedule will be agreed upon in the approved workplan. The preliminary schedule adheres to the guidelines to ensure a structured and efficient review process.

Phases are listed in series within this preliminary schedule. Tasks and Phases will occur in parallel when possible, condensing the overall schedule. Opportunities will be identified and detailed though the process.

By adhering to this detailed schedule and proactively managing review periods, we aim to ensure the successful completion of the project within the allocated timeframe, while maintaining the highest standards of quality and thoroughness.

Specific deliverable due dates are planned as follows:

Phase 1: Project Kickoff & Delivery (4 weeks)

Phase 1 is anticipated to take 4 weeks. A review and revision period are included to achieve consensus on the work plan. Initial background research and data collection will be completed concurrently with the work plan review period.

Phase 2: Energy Analysis (6-8 weeks)

Phase 2 is expected to be completed over a 6–8-week period. The deliverables associated with Phase 2 will be discussed with the MDT panel throughout the phase as the documents will be in a working condition. These documents are supplemental rather than final deliverables and do not necessitate a traditional review period and submittal.

Phase 3: Implementation Plan (12 weeks)

Phase 3 is anticipated to require 12 weeks. Ample review time has been added to the final deliverable and presentation, culminating at the end of Phase 3. This review period follows the requirements laid out by the RFP, ensuring thorough consideration and feedback. Therefore, the timeframe for the final report deliverable and the final presentation may vary depending on the total utilized review period.

Phase 4: Pilot Project Design (12 weeks)

The anticipated timeframe for the Phase 4 pilot study is estimated to be 12 weeks. This phase will largely be based on the results of Phase 3. This will result in the design deliverables as well implementation recommendations.

Table 1: Preliminary Project Schedule

Phase	Task	Description	Week 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Review and Revision Period (3-Cycles)
1	**Project kickoff and delivery**		*		*		**																			
	Task 1	Kickoff meeting and project workplan																								
	Deliverable	Kickoff meeting																								
	Deliverable	Project workplan																								
	Task 2	Background research																								
	Task 3	Data collection																								
2	**Energy Analysis**								*		*		**													
	Task 1	Building, infrastructure, and utility review																								
	Task 2	Building energy and operational assessment																								
	Task 3	Renewable energy technology review																								
	Task 4	Permitting and environmental considerations																								
	Deliverable	Building database spreadsheet																								
	Deliverable	Energy analysis presentation																								
	Deliverable	Renewable power technology matrix																								
3	**Implementation plan**														*		*		*		*		*		**	
	Task 1	Backup power and resilience energy modeling																								
	Task 2	Cost estimating																								
	Task 3	Lifecycle cost analysis																								
	Task 4	Funding and review																								
	Deliverables	Draft and Final Reports (Final, Research Summary, Implementation, Performance Measures, Poster)																							D1	Allows for review and response times in "Deliverables Format and Submission Process" Section F
	Deliverable 3-2	Final presentation and webinar																								*Tentative – dependent upon final report review period*

Phase	Task	Description	Week 36	37	38	39	40	41	42	43	44	Review and Revision Period (3-Cycles)
	Continuation of Schedule											
4	**Pilot Project Design**			*				*				**
	Task 1: Pilot PV Design											
	Task 2: Helena HQ PV Design											
	Deliverable 1: Pilot PV Design, Helena HQ Design										D	Allows for review and response times in "Deliverables Format and Submission Process" Section F
	Deliverable 2: Associated Report or Memo										D	F
	Task 3: Implementation Recommendations Analysis											

Key:

Phase Duration | Task Duration | Deliverable Timeframe
D = Draft deliverable provided to MDT
R = Draft deliverable reviewed and returned by MDT (allows approximately 1-month review period)
F = Final deliverable
* = Designates biweekly meeting
** = Designates meeting with Phase summary presentation

STAFFING

The successful execution of this research project hinges on the expertise and collaboration of a dedicated and highly qualified research team. Our team comprises professionals with qualified academic, professional, and research experience relevant to the project's objectives. Each member brings unique skills and knowledge crucial for the comprehensive evaluation and implementation of renewable energy solutions for MDT facilities. This section provides detailed background information for each team member who will significantly contribute to the project. Their backgrounds align with the project goals and outline their specific roles. Additionally, summaries of past and current projects in similarly related areas are included under the references section.

We have ensured that all listed staff members will maintain sufficient capacity to dedicate to this project. Table 5 shows the number of person-hours each research team member will devote to each task, ensuring clarity and accountability in our staffing plan. Principal investigators and other key professionals are listed by name and role in the study.

To further support the project, we have capable junior staff available to assist with various scope items as needed. This additional support ensures that all tasks are adequately staffed and that the project can proceed efficiently without delays.

This structured approach guarantees that all aspects of the project are adequately staffed and that each team member's expertise is optimally utilized, providing MDT with the highest quality of research and implementation support.

Table 5: Project Staffing

Name of Principal, Professional, Employee, or Support Classification	Role in Study	Phase						Percent of Time vs. Total Project Hours (total hrs. /person/total project hrs.)	Percent of Time - Annual Basis (total hours/ person/ 2080 hr.)
		0	1	2	3	4	Total		
Brian Stern	Program Manager/QAQC	2	2	2	2	2	10	2%	0%
Zoe Roberts	Project Manager	2	4	8	8	4	26	6%	1%
Nick Pedersen	Electrical Lead	4	4	8	8	12	36	8%	2%
Andrew Choi	Electrical Designer	2	8	24	24	36	94	22%	5%
Drew Karson	Energy Lead	4	18	32	32	2	88	20%	4%
Rachel Foertch	Energy Consultant	2	15	44	40	2	103	24%	5%
Brian Murphy	Technical Advisor	2	7	8	12	2	31	7%	1%
Monica Wright	Sr. Review/Sustainability Lead	10	0	0	0	0	10	2%	0%
Willenton Bridges Jr.	Data Analyst	2	10	10	10	0	32	7%	2%
TOTAL		30	68	136	136	60	430	N/A	N/A

COMMUNICATION AND QUALITY ASSURANCE

The research results from this project are intended to be highly applicable and actionable for MDT, enabling the department to make informed decisions and implement effective renewable energy solutions across its facilities. This section outlines how the findings will be reported, who will be responsible for applying the results, the standards and practices affected, and the implementation plan, including performance measures, costs, and barriers.

QUALITY CONTROL AND PROJECT REVIEW

To ensure the highest quality of deliverables throughout the project, a comprehensive quality assurance process will be implemented. This process will include the following components:

- **Editing and Review:** All deliverables will undergo a editing process to ensure clarity, accuracy, and adherence to MDT's standards. This will involve both in-house editing staff and subject matter experts, as necessary, to provide an objective assessment of the content and methodology. The review process will focus on validating the technical accuracy of findings and recommendations.
- **Feedback Incorporation:** Feedback from MDT and the Technical Panel will be actively sought and incorporated into the deliverables. This iterative process will help refine the content and ensure that it aligns with the expectations and needs of stakeholders.

Effective communication and ongoing quality assurance are critical to the success of the project. The following steps will be taken to facilitate regular communication and ensure quality control throughout the project lifecycle:

- **Regular Meetings:** Meetings will be scheduled between Tetra Tech Project Management and the Research Project Manager to discuss project progress, address any challenges, and review upcoming tasks. These meetings will provide a platform for open dialogue and timely feedback.
- **Progress Reports:** Monthly progress reports will be submitted to the Research Project Manager, detailing completed tasks, ongoing activities, and any issues encountered. These reports will also include updates on the status of deliverables and any adjustments to the project timeline.
- **Stakeholder Engagement:** Continuous engagement with MDT and other stakeholders will be prioritized to ensure that their insights and feedback are integrated into the project. This will include soliciting input during key phases of the research and providing opportunities for stakeholders to review and comment on draft deliverables.

By implementing these communication and quality control measures, the project will maintain a high standard of quality in its deliverables while fostering collaboration and transparency with MDT and other stakeholders. This proactive approach will help ensure that the research findings are actionable and aligned with MDT's goals and objectives.

STANDARDS AND PRACTICES AFFECTED

The research findings may impact the following standards and practices:

- **MDT Policies and Procedures:** Revisions to policies regarding energy management, sustainability practices, and facility maintenance.
- **Fiscal Requirements:** Adjustments to budget allocations and financial planning to accommodate renewable energy projects.

RISKS

Successful project execution requires not only a detailed plan but also a thorough understanding and management of potential risks. Identifying, assessing, and mitigating risks is critical to ensure that the project remains within the allocated budget, resources, schedule, and scope. The following section outlines the primary risks associated with this project, including budget, resource, schedule, and scope risks. Each risk is evaluated for its impact and probability, rated as high, medium, or low, and accompanied by mitigation measures, forewarning indicators, and contingencies.

By proactively identifying, assessing, and mitigating these risks, we aim to ensure the successful completion of the project within the allocated budget, resources, schedule, and scope.

Budget Risks

Risk: Budget Overruns

- **Impact:** High
- **Probability:** Low
- **Description:** There is a risk of budget overruns due to unexpected costs related to data collection, technology procurement, installation, or unforeseen complications during the project.
- **Mitigation Measures:**
    - **Detailed Budget Planning:** Develop a comprehensive budget plan with detailed cost estimates for all project phases.
    - **Regular Financial Reviews:** Conduct regular budget reviews and financial audits to track spending and identify any deviations early.
    - **Forewarning Indicators:** Regularly compare actual expenditures against budget projections. Sudden spikes or continuous trends of over-expenditure are key indicators.

Resource Risks

Risk: Resource Availability

- **Impact:** Medium
- **Probability:** Low
- **Description:** Limited availability of key personnel or external resources (e.g., specialized contractors, technical experts) could delay project progress.
- **Mitigation Measures:**
    - **Resource Planning:** Identify and secure key resources early in the project planning phase.

- **Cross-Training:** Ensure team members are cross-trained to cover critical tasks if specific individuals become unavailable.
- **Flexible Scheduling:** Develop a flexible project schedule that can accommodate minor delays in resource availability.
- **Forewarning Indicators:** Monitor resource allocation and utilization rates. High utilization rates or frequent unavailability of key personnel are warning signs.

Schedule Risks

Risk: Project Delays

- **Impact:** High
- **Probability:** Medium
- **Description:** Delays in data collection, stakeholder approvals, or technology procurement could extend the project timeline.
- **Mitigation Measures:**
  - **Detailed Project Schedule:** Develop a detailed project schedule with defined milestones and deadlines.
  - **Regular Progress Meetings:** Hold biweekly progress meetings to identify and address potential delays promptly.
  - **Buffer Time:** Include buffer time in the schedule for critical tasks to accommodate unexpected delays.
  - **Forewarning Indicators:** Regularly track project milestones. Missing or delayed milestones indicate potential schedule risks.

Scope Risks

Risk: Scope Creep

- **Impact:** Medium
- **Probability:** Medium
- **Description:** Expanding project scope beyond initial objectives could strain resources and budget.
- **Mitigation Measures:**
  - **Clear Scope Definition:** Clearly define the project scope and objectives in the project charter and work plan.
  - **Change Control Process:** Implement a formal change control process to evaluate and approve any proposed scope changes.
  - **Stakeholder Agreement:** Ensure all stakeholders agree on the project scope and any changes are communicated and approved.
  - **Forewarning Indicators:** Frequent requests for additional tasks or deliverables are indicators of potential scope creep.

Data Risks

Risk: Data Quality and Availability

- **Impact:** High
- **Probability:** Medium
- **Description:** Incomplete or inaccurate data could compromise the analysis and recommendations.
- **Mitigation Measures:**

- **Data Validation:** Implement robust data validation procedures to ensure data accuracy and completeness.
- **Multiple Data Sources:** Use multiple data sources to cross-verify critical information.
- **Stakeholder Coordination:** Work closely with MDT and other stakeholders to ensure timely and accurate data provision.
- **Forewarning Indicators:** Discrepancies in data sets or delays in data provision are key indicators of potential data risks.

Risk Mitigation Plan

To mitigate these risks effectively, we will:

1. **Develop a Comprehensive Risk Management Plan:** Document all identified risks, their impacts, probabilities, and mitigation measures in a formal risk management plan.
2. **Assign Risk Owners:** Designate specific team members responsible for monitoring and managing each identified risk.
3. **Regular Risk Reviews:** Conduct regular risk review meetings to update the status of identified risks and identify any new risks.
4. **Maintain Open Communication:** Ensure open communication channels between all stakeholders to facilitate early identification and resolution of risks.
5. **Implement Early Warning Systems:** Establish systems to monitor forewarning indicators and trigger pre-defined contingency actions when necessary.

BUDGET

The proposed budget can be found in a separate submittal document based on the Fee Proposal Spreadsheet included in the solicitation.

The total proposed budget is $96,680. The Spreadsheet provides a detailed budget with the hourly wage rate for each team member. Hourly rates are based reasonably on the Consultant's usual and customary practices at amounts normally charged for similar work. Salary rate increases are projected to be 4% annually which are aligned with recent annual increase rates, however this will not be required unless there is a schedule extension beyond the scope listed in Table 1. No travel or equipment expenses have been factored in to the budget.

OFFEROR QUALIFICATIONS

Offeror qualifications can be found in a separate submittal document that includes client reference forms, company profile and experience, and resumes.

PROOF OF AUTHORITY

See the following scanned, notarized documentation that certifies Chris Miele, Director at Tetra Tech, has signatory authority for Tetra Tech. Through the Tetra Tech Corporate Signatory Structure, Chris can delegate signing authority to Principals within his Operating Unit. Chris has delegated signing authority to Monica Wright for this proposal.

ACKNOWLEDGMENT BY PROPOSER

If Individual or Individuals:

STATE OF _____)
COUNTY OF _____) SS.:

On this _____ day of _____, 2024, before me personally appeared _____ to me known and known to me to be the same person(s) described in and who executed the within instrument, and he/she (or they severally) acknowledged to me that he/she (or they) executed the same.

_____
Notary Public, State of _____

If Corporation:

STATE OF Washington)
COUNTY OF King) SS.:

On this 16th day of January, 2024, before me personally appeared Christopher Mielle to me known, who, being by me sworn, did say that he/she resides at (give address) Sammamish, WA; that he/she is the (give title) Director of the (name of corporation) Tetra Tech Inc, the corporation described in and which executed the above instrument; that he/she knows the seal of the corporation, and that the seal affixed to the instrument is such corporate seal; that it was so affixed by order of the board of directors of the corporation, and that he/she signed his/her name thereto by like order.

SABRINE HASSANY NOTARY PUBLIC STATE OF WASHINGTON Commission Expires 03-20-2027 License Number 230842

_____
Notary Public, State of Washington

If Partnership:

STATE OF _____)
COUNTY OF _____) SS.:

On this _____ day of _____, 2024, before me personally came _____, to me known to be the individual who executed the foregoing, and who, being duly sworn, did depose and say that he/she is a partner of the firm of _____ and that he/she has the authority to sign the same, and acknowledged that he/she executed the same as the act and deed of said partnership.

_____
Notary Public, State of _____