Mission Electrification – Comprehensive and Scalable Approach to Electrifying the Department of the Air Force Non-Tactical Vehicle Fleet

Executive Summary

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This Executive Summary contains the following sections: Background, which provides context for the ESTCP proposal; Objectives, which summarizes the proposal's original goals; Technology Description, which discusses the Pilot Program's technical approach; a Performance Assessment; a discussion of Implementation Issues, followed by Program Highlights and conclusions.

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EXECUTIVE SUMMARY

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ACRONYMS AND ABBREVIATIONS

AFCEC	Air Force Civil Engineer Center
BPA	blanket purchase agreement
CaaS	charging as a service
CAP	Climate Action Plan
CO/CO	contractor owned/contractor operated
DAF	Department of the Air Force
DIU	defense innovation unit
DoD	Department of Defense
EO	Executive Order
ERCIP	Energy Resilience and Conservation Investment Program
ESAP	EVCF Siting and Acquisition Plan
ESCO	energy services company
ESPC	energy savings performance contract
ESTCP	Environmental Security Technology Certification Program
EV	electric vehicle
EVCF	electric vehicle charging facilities
EVSE	electric vehicle supply equipment
FAST Act	Fixing America's Surface Transportation Act
FSRM	facilities sustainment, restoration and modernization
GO/CO	government owned/contractor operated
GO/GO	government owned/government operated
GOV	government-owned vehicle
GSA	General Services Administration
GSA AWC	General Services Administration areawide contract
IDIQ	indefinite delivery/indefinite quantity
IGSA	intergovernmental support agreement
JBA	Joint Base Andrews
JBMDL	Joint Base McGuire Dix Lakehurst
MILCON	military construction
NTV	non-tactical vehicle
O&M	operation and maintenance
POV	personally-owned vehicle

SAF/IEE	Deputy Assistant Secretary of the Air Force for Environment, Safety and Infrastructure
UESC	utility energy service contract
UP	utilities privatization
ZEV	zero-emission vehicle

1.0 INTRODUCTION

In June 2021, the Office of the Deputy Assistant Secretary of the Air Force for Environment, Safety and Infrastructure (SAF/IEE) submitted a successful Environmental Security Technology Certification Program (ESTCP) proposal for a Pilot Program to develop and demonstrate an approach for electrifying the Department of the Air Force (DAF) non-tactical vehicle (NTV) fleet. The SAF/IEE Energy team selected two DAF installations as the initial pilot locations: Joint Base Andrews (JBA) and Joint Base McGuire Dix Lakehurst (JBMDL).

Over the course of developing, planning, and executing fleet electrification infrastructure projects in this first-of-its-kind program, the team learned valuable lessons. This knowledge shaped an evolving DAF NTV Fleet Electrification Program, the scope of which now includes 45 DAF installations. Disbursements for fleet electrification infrastructure projects total $32M across nine installations in FY23, with additional funding planned for FY24 and beyond.

This Executive Summary contains the following sections: Background, which provides context for the ESTCP proposal; Objectives, which summarizes the proposal's original goals; Technology Description, which discusses the Pilot Program's technical approach; a Performance Assessment; a discussion of Implementation Issues, followed by Program Highlights and conclusions.

1.1 BACKGROUND

SAF/IEE submitted the ESTCP proposal, under the Topic Area of Electric Vehicle (EV) Infrastructure Study, to address the following problem statement: The growing Department of Defense (DoD) emphasis on reducing military oil dependency, carbon emissions and climate impact, in addition to the Administration's energy goals, requires the DAF to develop a holistic approach to transitioning to a zero-emission vehicle (ZEV) NTV fleet.

The DAF centrally manages its vehicle fleet through the Air Force Deputy Chief of Staff for Logistics, Engineering and Force Protection, Directorate of Logistics. Legacy internal combustion engine vehicles rely on liquid petroleum fuel, with on-base refueling provided by the Defense Logistics Agency-Energy. Transitioning the DAF NTV fleet to ZEVs while sustaining mission success requires integrating vehicle refueling into a broader strategic energy resilience ecosystem, as shown in Figure ES-1, to ensure charging infrastructure is available when and where needed.

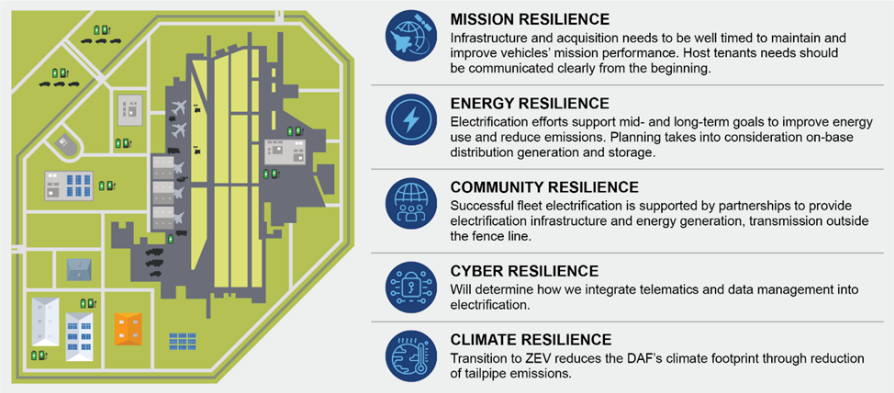

Figure ES-1. DAF Strategic Energy Resilience Ecosystem

1.2 REGULATORY DRIVERS

Electrifying the DAF NTV fleet and expanding supporting infrastructure addresses the goals and requirements of three foundational policy directives with direct implications for the DAF:

1. Secretary of the Air Force Operational Imperative 5, Defining Optimized Resilient Basing, Sustainment, and Communications.
2. The DAF Climate Action Plan (CAP) Priority 3, Optimize Energy Use and Pursue Alternative Energy Sources.
3. Executive Order (EO) 14057, Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability, incorporated in CAP Objective 3.2, Adopt Alternative Energy Sources.

The EO and CAP mandate all light-duty NTV fleet acquisitions be ZEVs by 2027, and all NTV fleet acquisitions must be ZEVs by 2035.

The DAF NTV Fleet Electrification Program resulting from the ESTCP proposal provides logistical, programmatic, and technical support to installations to meet these goals. Additionally, this program assists installations in complying with the Fixing America's Surface Transportation (FAST) Act of 2015, which authorizes the General Services Administration (GSA) and other Federal agencies to allow personally owned vehicles (POV) to charge at electric vehicle supply equipment (EVSE) funded by appropriations, provided they recoup the cost of electricity used in this way. If said EVSE is primarily occupied by POV charging, the agency must also recoup a share of the depreciated upfront costs.

2.0 OBJECTIVES

The ESTCP-funded Pilot Program set out to align fleet electrification planning with mission, energy, cyber, and community requirements as part of one comprehensive energy resilience ecosystem. This approach—described in detail in the original proposal and refined throughout the Pilot Program's execution—enabled installations to find optimal site-specific infrastructure acquisition tools to leverage state, community, and utility partnerships and to reduce required DAF capital by leveraging third-party financing authorities.

The DAF NTV fleet electrification approach addressed the following technical objectives in support of its ZEV acquisition goals:

- Conduct a "make-ready" analysis to determine the minimum amount of charging infrastructure required at each electric vehicle charging facility (EVCF), including quantities and types of chargers.
- Recommend an acquisition pathway and model for EVCF ownership and operation, based on an understanding of applicable options and installation needs.
- Develop an output called the EVCF Siting and Acquisition Plan (ESAP), according to the installation's charging requirements and acquisition strategy.
- Evaluate grid capacity to determine if sufficient capacity existed to support proposed EVCFs or whether a nearby/adjacent site should be considered.

- Identify the requirement for resilient charging at each EVCF (i.e., ensuring mission critical EVCFs remain operational during a power outage) and integrating EVCF resilience requirements into existing efforts or scoping new projects when necessary.
- Understand installation-specific concerns for cyber resilience and work to address them at the enterprise level.

3.0 TECHNOLOGY DESCRIPTION

To successfully electrify the NTV fleet in a manner that complements the DAF strategic energy resilience ecosystem, the DAF selected an approach to address multiple intersecting critical elements, such as mission and readiness, infrastructure planning, transaction management, legislative requirements, and regulatory issues. This approach used comprehensive stakeholder engagement to address relevant intersections and establish standards for how the DAF plans for, acquires, manages, and sustains EVSE. SAF/IEE selected JBA and JBMDL as the two baseline locations in the Pilot Program based on their array of vehicular assets, the status of their installation energy plans, and their existing partnerships with utility companies and potential community partners.

Figure ES-2 displays the overall array of DAF vehicle types from which installations build their respective requirements. DAF Agency Peculiar and Tactical Vehicles were not in the scope of this project or NTV fleet electrification. At this time, most available ZEVs are general purpose vehicles, but all Enterprise Commercially Available Vehicles are in scope and the DAF will replace them with a ZEV if a model with equivalent capabilities for the authorized DAF mission is available.

Figure ES-2. DAF Fleet Vehicles

4.0 PERFORMANCE ASSESSMENT

The ESTCP-funded component of the Pilot Program—consisting of the two baseline installations, JBA and JBMDL—demonstrated considerable success across several measures. First, SAF/IEE expanded the scope of the project to a full Pilot Program with a total of 18 sites (including those funded by ESTCP) in 2022 as shown in Figure ES-3. The second round of 16 sites is referred to as "Phase 2" of the Pilot Program. Next, the SAF/IEE Energy team produced a NTV Fleet Electrification Framework document to guide individual installations across the DAF in electrifying their vehicle fleets. Finally, the team developed and successfully demonstrated novel acquisition pathways, as well as ownership and operating models, to provide flexibility according to installations' circumstances. In August 2023, the NTV Fleet Electrification Pilot Program graduated from "Pilot" phases to a "Validation" phase (see Figure ES-3 also for these locations). The SAF/IEE Energy team, in partnership with the Air Force Civil Engineer Center (AFCEC), selected 27 DAF installations for the Validation Phase from across the Total Force—Air National Guard, Air Force Reserve Command, and U.S. Space Force. During the Validation Phase, the combined SAF/IEE and AFCEC Office of Energy Assurance teams will use the NTV Fleet Electrification Framework to establish the Fleet Electrification Program across the enterprise.

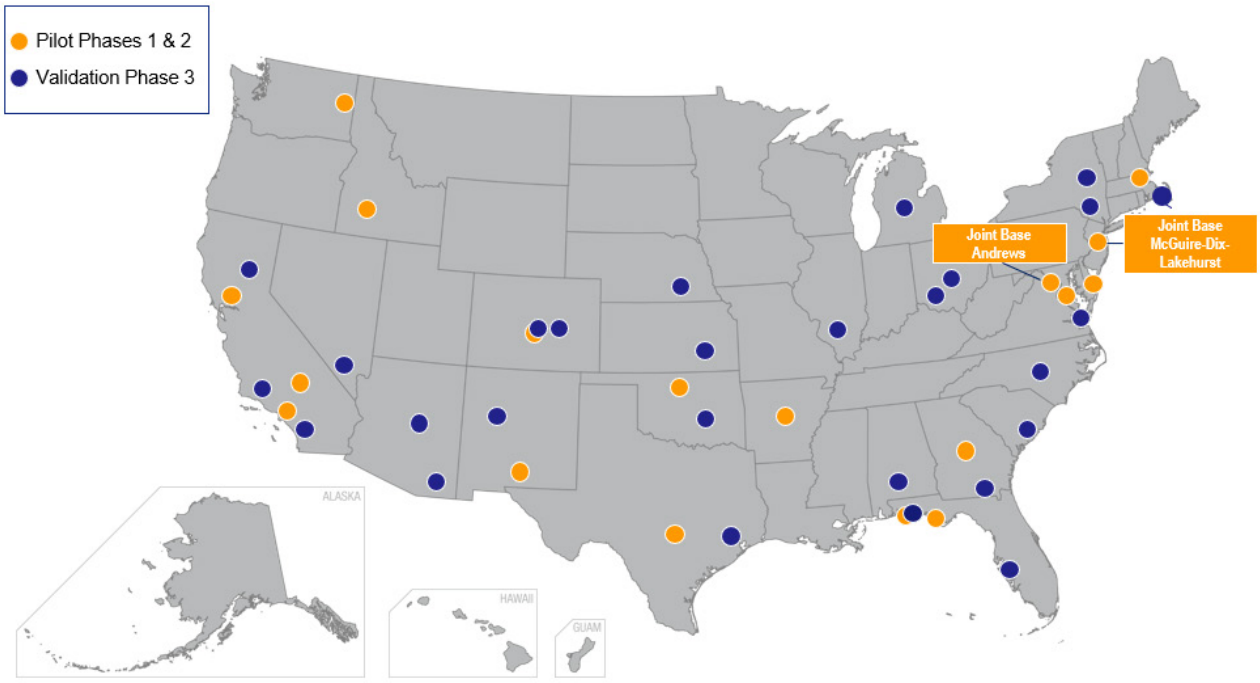

Figure ES-3. Pilot and Validation Phase Locations

4.1 NTV FLEET ELECTRIFICATION FRAMEWORK

The NTV Fleet Electrification Framework, or the "Framework," contains the preferred processes for DAF installations and organizations to electrify their NTV fleets. The document includes customary, established infrastructure requirements and processes, as well as systematic processes to plan and execute charging infrastructure projects to support arriving ZEVs. This strategy equips the DAF to accelerate integrating ZEVs into DAF NTV fleets in accordance with the DAF CAP and EO 14057.

The Framework is scheduled for release DAF-wide by end of calendar year 2023. Its structure is both informative and procedural, creating a guidebook of key concepts, interpretations, and instructions to define charging infrastructure requirements and plan EVCF, a DoD term defining—with some exceptions, such as portable charging stations and EVSE not connected to the grid—charging units and their supporting infrastructure as real property. The primary output of the Framework's procedure for a given installation is the EVCF ESAP, which comprises developing requirements based on the vehicle fleet's charging needs, as well as identifying an acquisition strategy.

When authoring the Framework, the SAF/IEE Energy team organized EVCF into three physical components (see Figure ES-4), which, when completed, would provide fully operational and supportive ZEV infrastructure within the energy resilience ecosystem. The Framework was organized into phases and provided step-by-step instructions for each EVCF component along with supporting information.

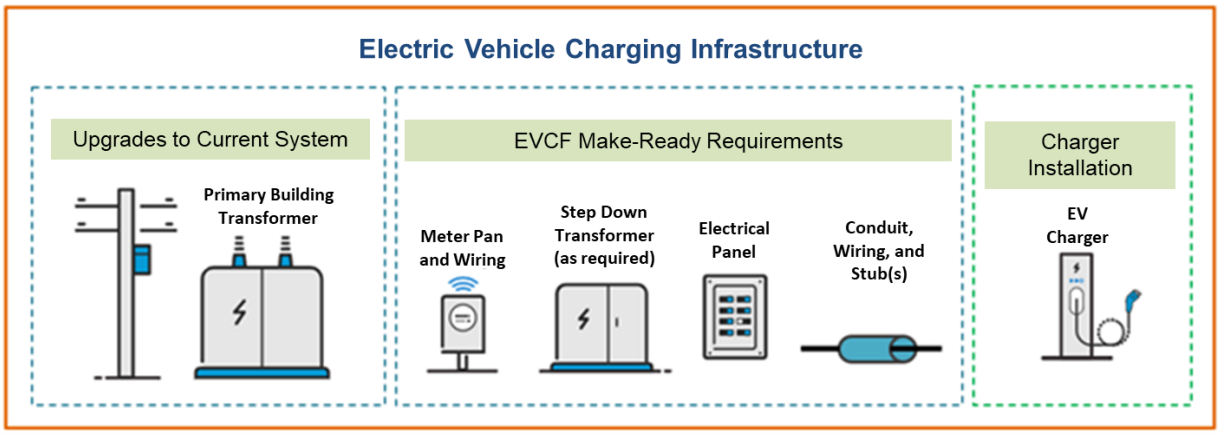

Figure ES-4. Three EVCF Components

Framework Phase 1—ESAP Development

The ESAP is a project development tool to define installation requirements for EVCF and associated infrastructure. The ESAP defines a scope of work to create programming, project planning, design and contract solicitation documents (i.e., DD Form 1391). Additionally, the ESAP helps ensure requirements are consistently applied across the DAF for funding considerations.

- *Requirements Development:* Steps to capture and analyze vehicle fleet data to determine EVCF site location(s), quantity of charging units, and timeline for operations. This phase also determines the need and opportunities for resilient charging infrastructure and energy resilience projects.
- *Acquisition Strategy:* Information and selection criteria to aid with selecting acquisition pathway(s). Each installation can access unique acquisition models and an EVCF may be the combination of multiple models, one for each of the three EVCF components.

Framework Phase 2—Project Execution: Methods and Supplemental Information

This section of the Framework presents a collection of project execution methods, including references to supplemental publications, to execute EVCF development.

Framework Phase 3—Operations and Expansion (to be developed as Framework evolves)

4.2 ACQUISITION PATHWAYS

During the Pilot Program, the team identified and refined multiple EVCF acquisition pathways available to DAF installations. These include:

- Utilities privatization (UP).
- GSA Areawide Contracts.
- GSA blanket purchase agreements (BPA) and indefinite delivery/indefinite quantity (IDIQ) Contracts.
- Energy Resilience and Conservation Investment Program (ERCIP).
- Military construction (MILCON) appropriated funds.
- Facility sustainment, restoration, and modernization funding.
- Intergovernmental support agreements (IGSA) utilizing state and local government partnerships.
- Energy savings performance contracts (ESPC), where an energy services company (ESCO) operates and sustains the charging infrastructure over a long-term contract.
- Utility energy service contracts (UESC) that enable the utility company to install and sustain charging stations.
- Multi-award construction contract.
- Charging as a service (CaaS), where a contractor installs, owns, operates, and manages a full EVCF solution. At each defense innovation unit (DIU) installation within the Fleet Electrification Program, the SAF/IEE Energy team is working to implement CaaS.

Figure ES-5 depicts how various acquisition pathways can support one or more components of EVCF deployment.

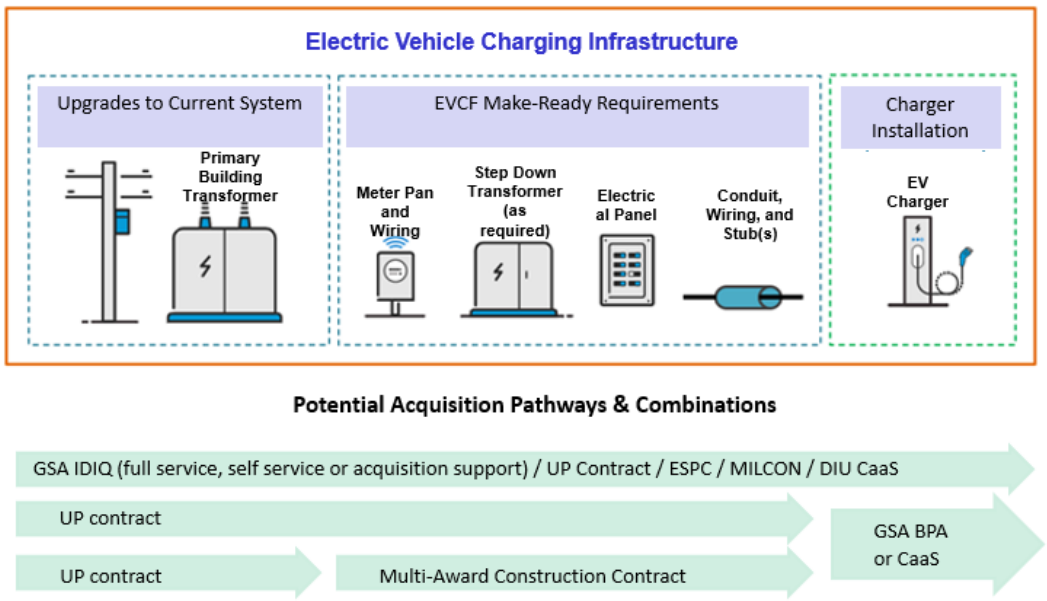

Figure ES-5. Example Acquisition Pathways Mapped to EVCF Components

The Framework provides factors for installations to consider when evaluating best-fit acquisition pathways including, but not limited to, the program's qualification requirements, funding timelines, monetary thresholds, eligible EVCF project components, and associated EVCF-compatible ownership models. The Framework requires installations to compare advantages and concerns for all potential acquisition pathways before selecting preferred options. The Framework includes a *Potential Acquisition Pathway Table* and an *Acquisition Tool Strength, Weakness, Opportunity and Threat (SWOT) Analysis* (see Appendix A) to guide installations toward the optimal combination of acquisition pathways to provide efficient, cost effective, contractor owned/contractor operated (CO/CO) CaaS business models. The SAF/IEE Energy team determined that the CO/CO model is preferred for DAF NTV fleet electrification, since it reduces ownership risks to the Government and addresses each component of an EVCF project.

4.3 OWNERSHIP AND OPERATING MODELS

Ownership and operating selections are required for both the make-ready infrastructure (the underlying distribution infrastructure to provide connection points for a charging station) and the charging station units. Each may be owned and operated under one of three different models: CO/CO, government owned/contractor operated (GO/CO), and government owned/government operated (GO/GO). Acquisition pathways may restrict the ownership and operating model for the EVCF. Therefore, installations should understand these models prior to selecting a pathway.

The DAF recommends that installations select the CO/CO model for EVCF charging units. This approach reduces initial costs and impacts to the installation as the third party provides operation and maintenance (O&M), while supplying data for reporting purposes. Depending on the pathway chosen for the Framework's Phase 1, the scope of the CO/CO may be the entire EVCF (make-ready and charging stations) or limited to the charging stations (where the DAF will own the make-ready).

GO/CO and GO/GO business models each add increasing government responsibilities to the installation. Advances in charging station technology introduce risk to the government in owning physical charging units, compared to a third party supporting the lifecycle. GO/GO models should be limited to government-owned vehicle (GOV) charging and can be beneficial in situations where the installation limits charging availability to non-tenant use. See Figure ES-6 for additional description and mapping of acquisition pathways to an EVCF project's lifecycle.

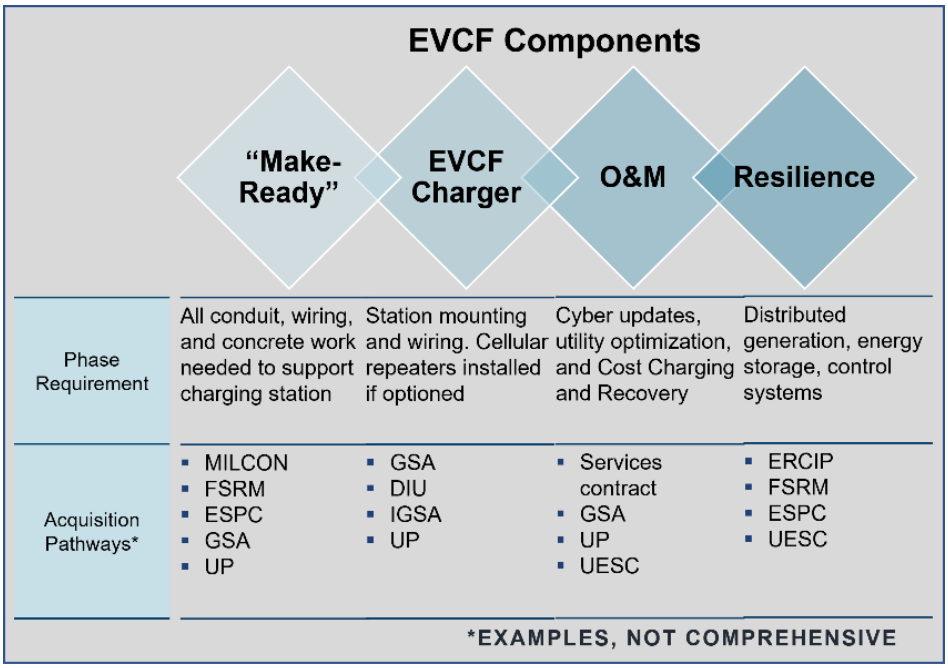

Figure ES-6. Charging Infrastructure Business Models and Project Components

5.0 IMPLEMENTATION ISSUES

The Pilot Program demonstrated considerable success by meeting acquisition targets across participating installations within an accelerated timeframe of 18 months. This rapid delivery, especially when compared to the usual pace of government contracting for infrastructure, was noteworthy.

During the implementation of the Pilot Program, the DAF uncovered policy gaps that called for new solutions. Not all installations had established pathways to recover the costs of distributing facility energy to contractor owned charging units, or to recover costs of providing electricity for charging of POVs. The FAST Act requires any POV charging to occur at no cost to the Government. Throughout the Pilot Program, the DAF engaged various stakeholders to inform and develop policies to guide installations on the use of facility energy, electricity as an alternative fuel, and CaaS solutions to enable FAST Act-compliant POV charging. The DAF also captured lessons learned from working with the DIU CaaS program for the first time as an acquisition pathway for multiple pilot installations and utilized this knowledge to refine SAF/IEE guidance for the ongoing NTV Fleet Electrification Program.

6.0 PROGRAM HIGHLIGHTS AND CONCLUSIONS

The DAF NTV Fleet Electrification Pilot was a first-of-its-kind program for widespread ZEV adoption in the DoD. Thanks to the approaches developed with ESTCP funding, the DAF expanded the Pilot Program into the Validation Phase and established a methodology scalable throughout the rest of the DAF Total Force.

Key accomplishments throughout the Pilot Program included the following:

- $32M in funding obligated at nine installations in FY23.
- Expansion of the Fleet Electrification Program from an initial Pilot Phase of two installations to 45 in the Validation Phase.
- Make-ready strategy: developing the full charging requirement to transition to a ZEV NTV fleet at a given DAF installation, while building only to the requirement and installing chargers in alignment with the vehicle fleet.
- The make-ready simulation tool, which optimizes make-ready infrastructure and port-to-vehicle ratio based on installation vehicle use-cases.
- Gaining understanding of POV charging availability in alignment with the FAST Act.
- Creation of a Policy Letter from SAF/IEE that empowers installations to implement FAST Act-compliant POV charging.
- Evaluation of EVSE cybersecurity configurations to increase cyber resilience as part of a broader energy resilience ecosystem.
- Addressing a DAF-specific challenge: scoping all GOV (DAF and non-DAF) in planning.
- Budget offset projections for enterprise-wide roll out.
- The ESAP structure that comprehensively defined installation charging requirements and identifies recommended acquisition pathways.
- The DAF NTV Fleet Electrification Framework that guided installations step-by-step in producing an ESAP.
  - Following the Framework and completing the ESAP provided executable project documentation for installations and DAF organizations.
  - The ESAP structure contained enough details for any of the 60 GSA IDIQ vendors to conduct a cost estimate without a site visit, as demonstrated at several installations in the program.
- Stakeholder engagement and review of DAF guidance on resilience and charging.
  - Submission of two pilot installations, including JBMDL, for ERCIP resilience funding.

ESTCP support has made it possible to pioneer these solutions. SAF/IEE looks forward to developing the program further as it evolves and scales throughout the DAF.

APPENDIX A ACQUISITION TOOL STRENGTH, WEAKNESS, OPPORTUNITY AND THREAT (SWOT) ANALYSIS

	Utilities Privatization (UP)	General Services Administration Areawide Contract (GSA AWC)	GSA Indefinite Delivery/Indefinite Quantity (IDIQ) and Blanket Purchase Agreement (BPA)	Energy Resilience and Conservation Investment Program (ERCIP)	Military Construction (MILCON)	Facility Sustainment, Restoration and Modernization (FSRM)	Intergovern-mental Support Agreement (IGSA)	Energy Savings Performance Contract (ESPC)	Utility Energy Service Contract (UESC)	Charging as a Service (CaaS)
Strengths	• Existing UP contracts can be modified to incorporate new infrastructure • O&M and repair and replacement will be covered through the UP contract	• Quickly scalable across most installations • Established pricing • No initial cost to using a GSA AWC	• New contract tool designed specifically for EVCF	• Process is thoroughly established • Supports large scale project development from Congressionally directed funding	• Process is thoroughly established • Supports large scale project development from Congressionally directed funding	• Process is thoroughly established • Can be managed locally at an installation	• Leverages local non-DoD EVCF • Enables third party ownership and maintenance • May be ideal for installations supplied by municipal utilities	• An ESCO will operate and sustain the charging infrastructure • Competitive bidding process ensures best value	• Preferred acquisition pathway for many utility partners • Utility can sign an O&M contract to service EVCF for the duration of the contract	• A contractor will install, own, operate and manage a full EVCF solution • Supports multiple end-users
Weaknesses	• Inability to purchase at scale, such as blanket GSA purchases, may impact pricing • Not available for all installations	• Minimal competition may impact pricing • Limited by the availability of appropriated funds • Scope challenges with local contracting officers	• Not fully available for all regions (awaiting confirmation from GSA)	• ERCIP collects project concepts once per year for projects in future fiscal years resulting in funding delays • Procurement may take several years	• Limited by availability of appropriated funds • Procurement may take several years	• Limited by an FSRM cost threshold • Competes locally with other FSRM priorities • Requires sustainment funding	• Requires local government to already be providing EVCF	• EVCF will become real property at the end of the performance period, except for mobile Level 1 chargers • Financing charges lead to higher overall cost	• Not all utilities offer UESCs	• Procurement pathway is unknown/non-standard

	Utilities Privatization (UP)	General Services Administration Areawide Contract (GSA AWC)	GSA Indefinite Delivery/Indefinite Quantity (IDIQ) and Blanket Purchase Agreement (BPA)	Energy Resilience and Conservation Investment Program (ERCIP)	Military Construction (MILCON)	Facility Sustainment, Restoration and Modernization (FSRM)	Intergovern-mental Support Agreement (IGSA)	Energy Savings Performance Contract (ESPC)	Utility Energy Service Contract (UESC)	Charging as a Service (CaaS)
Opportunities	• Make-ready, Electric Vehicle (EV) chargers, O&M, resilience • "As a service" opportunities that can support multiple end-users	• Make-ready, EV chargers, O&M, resilience • State and federal incentives can allow savings	• Make-ready (IDIQ), EV chargers (BPA), O&M (BPA) • "As a service" is included in the BPA • Can be combined with other acquisition paths for the make-ready or the charger	• Make-ready, resilience • Can use for EVCF • Congress is responsible for project funding	• Make-ready, resilience projects	• Make-ready, resilience, EV chargers	• Make-ready, resilience projects • "As a service" opportunities that can support multiple end-users	• Make-ready, O&M, resilience • Potential for no upfront capital costs • State and federal incentives can allow savings	• Make-ready, O&M, resilience • Potential for no upfront capital costs • State and federal incentives can allow savings • "As a service" opportunities that can support multiple end-users	• Make-ready, EV chargers, O&M, resilience • The DAF is piloting a CaaS solution through DIU • State and federal incentives can allow savings
Threats	• UP provider's interest varies from base to base. Some providers are reluctant to extend work into make-ready or charging services.	• Installation must rely on the utility provider for the installation of make-ready and charging stations	• Unknown procurement timeline and processes • Varying information on ability to obtain networked charging units based on cybersecurity requirements	• Project prioritization for charging infrastructure remains unclear. Traditional projects are prioritized based on mission need	• Competitive process across DoD; award not guaranteed	• Possibly limited to DAF use only based on reimbursement and collection processes	• May require public access to charging equipment	• Scalability limited by amount of energy/O&M cost savings/avoidance generated on the contract to cover cost of EVCF	• Financing charges may lead to higher overall cost • UESC contractor's interest varies from base to base and could be make-ready and/or charging unit and/or resilience	• Cost/business models are unknown