



FINAL REPORT

Military Energy Resilience Catalyst

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14. ABSTRACT The Military Energy Resilience Catalyst (MERC) Program Final Report outlines the results and takeaways from the MERC Environmental Security Technology Certification Program (ESTCP) Demonstration, a technology transition accelerator for energy resilience projects. MERC's objective was to accelerate Department of Defense (DoD) project development by identifying and disseminating standard, widely deployable practice by providing direct facilitation and technical assistance to projects through workshops; establishing a permanent and user-friendly online community; and creating a network of energy-related professionals to support ongoing innovation. MERC convened key stakeholders in-person facilitated workshops that were highly customized to maximize project progress. MERC also provided ad-hoc project development support through the deployment of limited specialized faculty members that provided customized technical assistance to project teams - both during workshops and on an on-call basis. MERC also established a centralized repository of searchable project information, derived from previously pursued energy resilience projects and a library (links to online resources and uploads of standalone tools where possible) of available microgrid planning and design tools; and MERC connected and aligned the broader DoD energy resilience community across the Services through a series of in-person events, regular virtual exchanges on topics of interest sourced from project teams, and the MERC online community.					
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TABLE OF CONTENTS

	Page
ABSTRACT	VII
1.0 INTRODUCTION	1
1.1 BACKGROUND	2
1.2 OBJECTIVE OF THE DEMONSTRATION.....	3
1.3 REGULATORY DRIVERS	3
2.0 TECHNOLOGY DESCRIPTION	5
2.1 TECHNOLOGY OVERVIEW	5
2.1.1 Description.....	5
2.1.2 Visual Depiction	8
2.1.3 Future Potential for DoD	8
2.2 TECHNOLOGY DEVELOPMENT.....	8
2.2.1 Pre-ESTCP MERC Development.....	8
2.2.2 MERC in 2019	9
2.2.3 MERC in 2020	9
2.3 ADVANTAGES AND LIMITATIONS OF THE TECHNOLOGY.....	10
2.3.1 Direct technical assistance through facilitated Installation Resilience Workshops	10
2.3.2 Permanent and user-friendly Online Community	11
2.3.3 Network of energy-related professionals	11
3.0 PERFORMANCE OBJECTIVES	13
3.1.1 Details on metrics and desired results.....	14
4.0 FACILITY/SITE DESCRIPTION.....	16
4.1 FACILITY/SITE LOCATION AND OPERATIONS.....	17
4.2 FACILITY/SITE CONDITIONS	19
5.0 TEST DESIGN	20
5.1 CONCEPTUAL TEST DESIGN.....	20
5.2 BASELINE CHARACTERIZATION.....	20
5.3 DESIGN AND LAYOUT OF TECHNOLOGY COMPONENTS	20
5.4 OPERATIONAL TESTING.....	20
5.5 SAMPLING PROTOCOL	21
5.5.1 Quantitative Data: Performance Objectives 1, 3-6	21
5.5.2 Qualitative Data: Performance Objectives 2, 7.....	21
5.6 SAMPLING RESULTS.....	22
6.0 PERFORMANCE ASSESSMENT	23
7.0 COST ASSESSMENT.....	27

TABLE OF CONTENTS (Continued)

	Page
7.1 COST MODEL	27
7.2 COST DRIVERS	27
7.3 COST ANALYSIS AND COMPARISON.....	28
8.0 IMPLEMENTATION ISSUES	29
8.1 END USER FACTORS	29
APPENDIX A POINTS OF CONTACT.....	A-1
APPENDIX B ARCHIVED RESULTS.....	B-1

LIST OF FIGURES

	Page
Figure 1. Three Pillars of MERC	8

LIST OF TABLES

	Page
Table 1. Performance Objectives	13
Table 2. Number of Monthly Page Views - MERC Online Community.....	24
Table 3. Cost Model (Annual) Overview for MERC Program or MERC 2.0	27
Table 4. Cost Drivers for MERC Program	28
Table 5. Cost Drivers for Optional Workshops	28

ACRONYMS AND ABBREVIATIONS

AFB	Air Force Base
CSL	Converge Strategies, LLC
CUI	Controlled Unclassified Information
DoD	U.S. Department of Defense
DTA	Detroit Arsenal
EMIG	Energy Mission Integration Group
ESPO	U.S. Navy Energy Security Programs Office
ESTCP	Environmental Security Technology Certification Program
FEMP	Federal Energy Management Program
FOUO	For Official Use Only
FTC	Fort Campbell
IEP/IEWP	Installation Energy Plan/Installation Energy and Water Plan
INL	Idaho National Laboratory
KAFB	Kirtland Air Force Base
MERC	Military Energy Resilience Catalyst
MERC-AF	2017 MERC pilot project
NAS	Naval Air Station
NSIN	National Security Innovation Network
ODCs	Other Direct Costs
OEA	U.S. Air Force Office of Energy Assurance
OEI	U.S. Army Office of Energy Initiatives
POC	Point of contact
POP	Period of performance
RMI	Rocky Mountain Institute
SERDP	Strategic Environmental Research and Development Program
SJAFB	Seymour Johnson Air Force Base
USAG	U.S. Army Garrison

COMMON TERMS

(MERC) Cohort	DoD energy resilience practitioners, usually at installations
(MERC) Faculty	Resilience experts, policymakers, and leaders from DoD, labs, and beyond
MERC Major Events	Technology Demonstration Site Visit + FEMP Energy Exchange + SERDP-ESTCP Symposium
MERC Network	MERC Cohort + Faculty
MERC Team	MERC investigators: CSL + INL
Program Offices	For the purposes of this report, the DoD program offices are the OEA + OEI + ESPO

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ABSTRACT

INTRODUCTION AND OBJECTIVES

Given the increasing frequency, duration, and consequences of power disruptions, whether natural or manmade, the Department of Defense (DoD) has committed to strengthening energy security and resilience. Resilient energy project development must be accelerated and scaled to meet DoD policy requirements and respond to the evolving threat environment. Converge Strategies, LLC (CSL) and the Idaho National Laboratory (INL), together the “MERC Team,” executed the Military Energy Resilience Catalyst (MERC) program, a technology transition accelerator for energy resilience projects that includes an enduring online community of DoD energy resilience practitioners. MERC’s objective was to improve DoD project development by identifying and disseminating standardized, widely deployable practices.

TECHNOLOGY DESCRIPTION

The MERC Team deployed a set of three distinct and complementary efforts to better establish, replicate, and scale resilient energy project development across DoD. These efforts included:

- Providing direct facilitation and technical assistance to projects through Installation Resilience Workshops,
- Establishing a permanent and user-friendly Online Community, and
- Creating a MERC Network of energy professionals to support ongoing innovation.

PERFORMANCE AND COST ASSESSMENT

The MERC program was evaluated against seven key performance objectives. MERC has resulted in a more connected, active, informed, and effective DoD resilience community. Notable outcomes of the program include:

- Two full-year MERC Cohorts representing each of the Military Services,
- A growing MERC Faculty, numbering over 40 members, to provide on-call expertise and assistance to the MERC Cohort,
- Direct support to more than 40 installations through the MERC program, and
- Nine Installation Resilience Workshops that identified concrete energy project opportunities.

Costs of the MERC program were divided into the following elements: labor, travel/other direct costs (ODCs), workshop labor, and workshop travel/ODCs. The bulk of costs were in labor – conducting resilience workshops, recruiting, and supporting the MERC Network, and organizing the associated programming for Network events, regular meetings, and technical support.

IMPLEMENTATION ISSUES

The two largest issues faced during implementation were:

- Time and Availability: Cohort members are busy DoD professionals maintaining full-time jobs as Installation Energy Managers, project managers, and community outreach specialists, among others. Cohort members often fill more than one role at their installation due to staffing needs, and many faced competing priorities during the period of performance.
- Frequent Turnover: Energy resilience positions at DoD installations see high turnover. Several Cohort members changed roles or jobs during their Cohort tenure.

PUBLICATIONS

None

1.0 INTRODUCTION

Given the increasing frequency, duration, and consequence of power disruptions, whether natural or manmade, the Department of Defense (DoD) is prioritizing energy security and resilience. Resilient energy project development across the DoD must be accelerated and scaled to meet the increasing demand for these projects. Converge Strategies, LLC (CSL) and the Idaho National Laboratory (INL), together the “MERC Team,” executed the Military Energy Resilience Catalyst (MERC) program, a technology transition accelerator for energy resilience projects that includes an enduring online community to provide guidance and support. MERC’s objective was to improve DoD project development by identifying and disseminating standard, widely deployable practices.

MERC program support was largely divided into the following three program pillars:

- Providing direct facilitation and technical assistance to projects through Installation Resilience Workshops,
- Establishing a permanent and user-friendly Online Community, and
- Creating a MERC Network of energy professionals to support ongoing innovation.

Installation Resilience Workshops

Direct support for energy resilience practitioners on DoD installations is limited. Installation Resilience Workshops supported on-base personnel to focus on actionable energy resilience projects. Installation stakeholders worked together to identify resilience requirements and develop solutions that would address resilience gaps. The workshops provided support to the installation’s energy project development process and pipeline prioritization. Specifically, workshops focused on identifying existing requirements and capabilities, engaging stakeholders, and refining project concepts. Workshops also enabled stakeholders to identify and discuss opportunities to integrate ESTCP-funded technologies into their long-term resilience strategies.

Online Community

The goal of the MERC Online Community was to overcome the limitations presented by the infrequent tempo of energy resilience-focused convening (e.g., the annual Federal Energy Management Program (FEMP) Energy Exchange). The MERC Team recognized that:

- Due to the sheer volume and diversity of DoD resilience efforts, it is difficult for resilience practitioners to keep up with changing trends and best practices.
- Policy and guidance documents are often Service-specific, and there are few shared lessons learned examples across the Services.
- Energy resilience staff turnover at installations is typically high.

By creating an enduring forum for practitioners to connect, learn, and hone their skills, the MERC program sought to mitigate the challenges posed by siloed and fragmented resilience knowledge within the DoD. Today, the Online Community hosts relevant and updated information that is accessible to Online Community members at any time.

MERC Network

The MERC Team identified the absence of a community of practice focused on energy resilience within the DoD as a barrier to energy resilience project success. The MERC Network addresses this absence by intentionally linking DoD installation personnel, mission owners, headquarters officials, policymakers, and technical experts through in-person Major Events (see section 2.1 for more details) and by facilitating professional connections between resilience practitioners and MERC Faculty. Through Major Events, MERC Cohort members are able to connect with and build their network of other energy resilience professionals, meet with specific policy makers or technical experts to address specific challenges, and work in facilitated sessions to clarify their own strategic objectives. Periodic Major Events also keep the network in contact and up to date with the most recent advances in energy resilience practices and technology and ensure that members build and maintain rapport.

1.1 BACKGROUND

Assured access to electricity on installations is becoming more important to military operations. The current model for military energy resilience relies heavily on diesel generators and uninterruptible power systems for critical equipment and facilities. These technologies are insufficient for the current threat environment. DoD policy emphasizes the use of advanced energy technologies for energy resilience, but the pace of progress remains behind the evolving threat environment. As the DoD's energy testbed program, the Environmental and Security Technology Certification Program (ESTCP) serves a critical role in developing, validating, and deploying advanced energy technologies on DoD installations, but still faces substantial challenges in transitioning successful technologies across the DoD enterprise. These challenges include:

- Identifying and engaging with high-capacity host installations and personnel;
- Transitioning validated technologies to the field; and
- Diffusing energy resilience technologies, practices, lessons learned, and guidance through an enterprise-wide community of practice.

From 2017 to present, the MERC Team demonstrated the value of the MERC program to DoD officials, practitioners, and installations across the country. MERC supported the practice of resilient energy development and aided the implementation of energy resilience projects for DoD installations. MERC shared lessons learned across projects and increased the comprehensiveness of energy resilience projects to protect critical missions from disruption. MERC also improved efficiency for new projects by providing access to data and information from previous projects, as well as templates and tools that leaders can use to better scope projects or define project objectives. By facilitating Installation Resilience Workshops, creating an Online Community and repository for DoD sharing energy resilience information, and building a Network of Faculty advisers and project champions, MERC created vital connections between practitioners that have strengthened the overall field of energy resilience in the DoD.

1.2 OBJECTIVE OF THE DEMONSTRATION

MERC's objective was to streamline DoD project development by identifying and disseminating standardized, widely deployable practices, specifically by:

- Providing direct facilitation and technical assistance to projects through Installation Resilience Workshops,
- Establishing a permanent and user-friendly Online Community, and
- Creating a Network of energy professionals to support ongoing innovation.

Current energy resilience efforts within the DoD are numerous, diverse, and largely uncoordinated. The Military Services have pursued varying approaches to address energy resilience, and the skillsets and expertise required to achieve resilience objectives are varied. When compounded with typical staff turnover, the opportunities to create an enduring forum for practitioners to connect, hone their skills, learn from one another, and expand implementation are limited. MERC has helped address those problems and bolster the development of energy resilience projects in ways that would be otherwise unachievable.

Validate: The project team established performance objectives and associated metrics, detailed in Section 3.0, to baseline and track the creation and development of energy resilience projects across DoD.

Findings and Guidelines: The demonstration established an Online Community and MERC Network that will continue to identify best practices in the creation and development of energy resilience projects to ensure their widest dissemination. MERC also fostered a centralized means of discussion where policies, standards, and regulations that need change can be identified.

Technology Transfer: By increasing information flow to installations, knowledge-related barriers to energy resilience projects have been reduced.

Acceptance: By providing an accessible repository of energy resilience project reports, more practitioners can both see the impact of energy resilience projects and understand how to implement such projects themselves.

1.3 REGULATORY DRIVERS

The following are primary regulatory drivers of the MERC program:

- 2018 National Defense Strategy of the United States of America
 - States that, “[i]t is now undeniable that the homeland is no longer a sanctuary,” and that “[d]uring conflict, attacks against our critical defense, government, and economic infrastructure must be anticipated.” (Italics in original text)
- 10 U.S. Code § 2911(g) – Energy policy of the Department of Defense
 - Outlines goal regarding use of renewable energy to meet facility energy needs and specifies that energy resilience and energy security are the central tenets of DoD energy policy.

- John S. McCain National Defense Authorization Act for Fiscal Year 2019 § 2805, Pub. L. No. 115-232 (Aug. 13, 2018)
 - Supplies updates and modifications to Department of Defense form 1391, Unified Facilities Criteria, and military installation master plans.
- Executive Order (EO) 13990 Protecting Public Health and the Environment and Restoring Science To Tackle the Climate Crisis
 - Partially revokes 13834: Efficient Federal Operations, also applicable. EO 13990 states, “It is...the policy of [the] Administration...to bolster resilience to the impacts of climate change.”
- DoD Directive 4180.01
 - States that DoD’s policy is “to enhance military capability, improve energy security, and mitigate costs in its use and management of energy”, and that DoD will “[d]iversity and expand energy supplies and sources, including renewable energy sources and alternative
- Installations Energy Instruction DODI 4170.11
 - Provides specific guidance on energy resilience at military installations and identifies renewable energy and distributed generation as priority options for providing energy resilience, energy security, and backup power.
- DASD (IE) memo, “Energy Resilience Operations, Maintenance, and Testing Guidance,” dated 17 Mar 2017
 - Provides guidance from OSD to all Military Services to assist with the implementation of energy resilience projects.
- DASD (EI&E) “Guidance on Development of Energy Projects,” dated 3 Nov 2016
 - Offers a roadmap to ensure that submitted projects are consistent with requirements for projects completed under authorities 10 USC 2667, 10 USC 2668, or 10 USC 2922(a).
 - fuels.”
- Army Directive 2020-03 (Installation Energy and Water Resilience Policy)
 - Supersedes the “14-day requirement” set out in Army Directive 2017-07. 2020-03 provides authority to Army senior commander or higher HQ to determine the appropriate duration for which critical missions must be able to function, with electricity and water, in the event of an outage. Mandates that energy and water supplies be readily available to critical missions.

2.0 TECHNOLOGY DESCRIPTION

The MERC Team deployed a set of three distinct and complementary efforts to better establish, replicate, and scale resilient energy project development across DoD. A visual depiction of these efforts can be found in Figure 1. These efforts included:

Installation Resilience Workshops. The MERC Team facilitated in-person or virtual workshops at six installations (across all Military Services). Installation Resilience Workshops convened key installation, DoD, leadership, and community or industry stakeholders when appropriate. With certified facilitation staff guiding the multi-day experiences, workshops were highly customized to each installation to maximize project progress. MERC also provided ad-hoc project development support through the deployment of specialized Faculty members.

MERC Online Community. The MERC Team established a centralized repository of searchable project information, derived by collecting and analyzing previously pursued energy resilience projects, performing in-depth research for energy resilience data and applicable DoD information, and by continuously funneling new information into the Online Community to keep members apprised of the most current energy resilience information.

MERC Network. The center of the MERC Network is the MERC Cohort – a collection of 18 energy resilience practitioners (six from each Military Department) recruited annually from installations around the United States. MERC Faculty members were recruited and engaged to support the MERC Cohort. Faculty members are DoD headquarters staff, policy makers, Military Services energy program office representatives, select Cohort alumni, national laboratory experts, academics, and energy resilience nonprofit leaders, among others. MERC Faculty provide customized technical assistance to Cohort members - both during workshops and on an on-demand basis. The MERC Team connected and aligned the broader DoD energy resilience community across the Services through a series of in-person events, as well as regular virtual exchanges on topics of interest sourced from project teams and the MERC Online Community.

2.1 TECHNOLOGY OVERVIEW

2.1.1 Description

Installation Resilience Workshops

Installation Resilience Workshops were discrete, in-depth engagements at installations designed to develop resilience requirements, assess existing technical capabilities, and identify solutions that would address the resilience gaps at the installation, including solutions that could be provided by ESCTP or other DoD project funding. The workshops also provided support to the installation’s energy project development process and pipeline prioritization. Specifically, they focused on identifying existing requirements and capabilities, engaging stakeholders, and aiding project refinement. These multi-day engagements provided time for joint analysis and problem solving with a selection of stakeholders at the installation, ranging from mission owners and operators, installation leadership, tenants, subject matter experts, funding sponsors, and, when necessary, community representatives and utility providers.

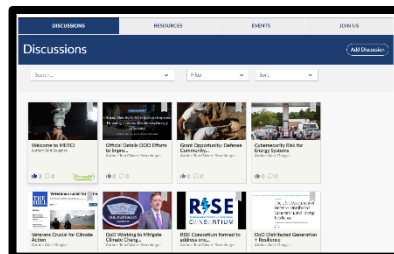


Workshops empowered stakeholders to identify and discuss opportunities to integrate new or proven ESTCP technologies into their long-term resilience strategies.

Installation Resilience Workshops were led by a trained facilitator in partnership with a DoD energy program office or DoD headquarters representative. The MERC Team selected and worked with an installation champion (usually a MERC Cohort member) and their team to refine the objectives of the Installation Resilience Workshop and tailor the workshop to specifically address the highest priority resilience needs.

Online Community

The MERC Online Community is an enduring location to aggregate relevant documentation and insights for the DoD energy resilience community to support higher quality, more rapid project development and sharing of lessons learned across services and locations. The MERC Online Community is hosted by the National Security Innovation Network (NSIN) at innovatedefense.net/merc. The Online Community is divided into two main sections: the main site and a subsite. The main site is open to all government personnel and government contractor registrants while the subsite is only accessible by MERC Network members and included project information specific to MERC Cohort members.



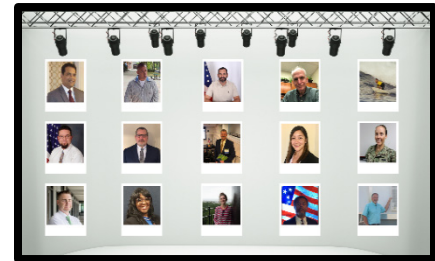
The MERC Online Community provides a wealth of resources and the ability to catalog, store, centralize, and access DoD-relevant energy resilience information such as project reports, tools, policy documents, case studies, discussions, and events.

- *Reports* - a collection of more than 40 publications relevant to energy resilience project execution. Reports cover a wide range of subjects, from guides to navigating Risk Management Framework for Distributed Energy Resources to DoD Resilience handbooks to technical publications from Department of Energy national laboratories.
- *Case Studies* - deep dives into select DoD energy resilience projects. Case studies are sources of valuable lessons learned and project execution pathways across the Military Services.
- *Policies* - descriptions and links to currently applicable energy resilience policies. The Online Community currently contains more than 30 policies, which are easily sortable by Military Service. The MERC Team has also created guidance “listicles” which quickly summarize major policies and the applicability of each.
- *Tools* - a repository of more than 50 tools for energy practitioners to aid in the execution of DoD energy resilience projects. Tools include both commercially available and free applications and are sortable by their cost. Tools include proprietary solutions, such as the XENDEE One-Line Diagram Designer, and those built by national laboratories, like National Renewable Energy Lab’s ReOpt Techno Economic Decision Support model. The MERC Team has also created a Tool Index which quickly summarizes the tools on the Online Community and describes use cases for each.

- *Discussions* - a forum for all Online Community members to comment on and contribute to the latest in energy resilience news, announcements, and conversations. The MERC Team updates Discussions on a weekly basis.
- *Events* - a collection of constantly updated events, particularly virtual events, that cover one or more topics related to DoD energy resilience project execution.

MERC Network

The MERC Network is a sustained community of practice for energy resilience practitioners that provides firsthand knowledge resources and shares best practices. Building a sustained Network required two major components: first, creating an annual Cohort and supportive Faculty roster; second, executing monthly webinars, MERC Major Events, and regular small group meetings to bring network members together regularly and demonstrate ongoing value.



The center of the MERC Network was the MERC Cohort – a collection of 18 energy resilience practitioners (six from each Military Department) each year based at installations around the United States. Through its Cohort model, MERC directly engaged more than 40 installations. The MERC Cohort allowed for a full year of constant contact with current and future DoD energy leaders across geographic, Military Service, rank, and institutional silos. The Cohorts consisted of installation energy resilience practitioners from each of the Military Services. MERC Cohort members included installation energy managers, regional energy managers, installation planners, mission owners and operators, engineers, community liaisons, policy makers, and more.

While Cohort members were the central focus of the project, MERC programming relied heavily on external, in-kind support from Faculty members, who provided direct technical assistance. The Faculty members included DoD headquarters staff, policy makers, Military Services energy program office representatives, select Cohort alumni, national laboratory experts, academics, and energy resilience nonprofit leaders, among others. At its inception, the MERC Faculty was composed of fewer than 20 individuals. Today, the MERC Faculty consists of more than 40 members and continues to grow. MERC Cohort members identify the need for experts in a growing number of areas related to energy resilience, particularly resilience training, water infrastructure and policy, and cybersecurity. In turn, the MERC Faculty will continue to grow to meet these identified needs.

Ongoing Network engagement provided the foundation of the MERC program’s sustainment, as exemplified in monthly webinars, MERC Major Events, and regular small group meetings. This programming provided key touchpoints for technology transition, project acceleration, and community building. The MERC Team connected and aligned the energy resilience community through three annual MERC Major Events: one Technology Demonstration Site Visit, the FEMP Energy Exchange, and the SERDP-ESTCP Symposium. MERC Major Events fostered the dissemination of knowledge to DoD professionals interested in resilience. MERC Major Events functioned as avenues for technology transition, as MERC Cohort members identified technologies or technology providers to engage for their installation’s energy resilience needs.

2.1.2 Visual Depiction

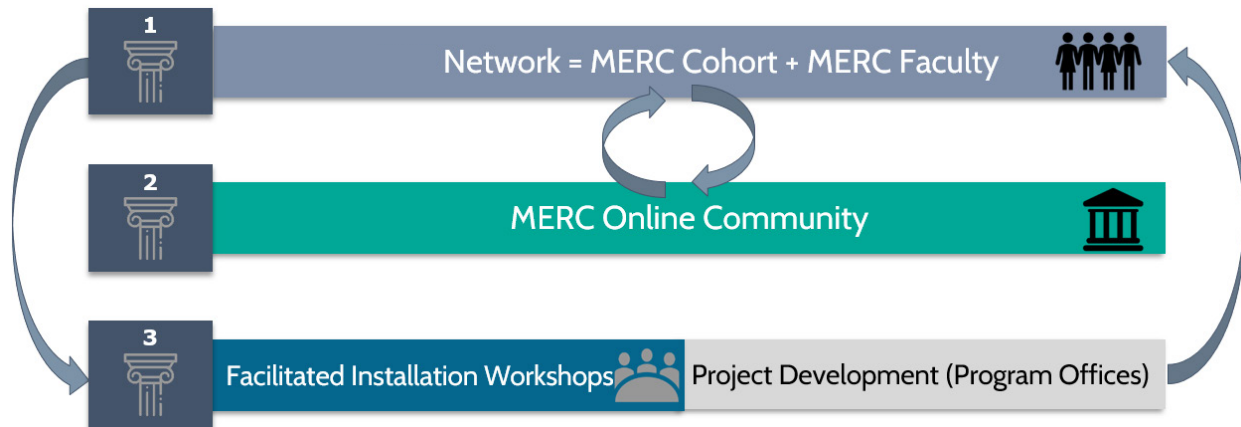


Figure 1. Three Pillars of MERC

2.1.3 Future Potential for DoD

As the DoD continues to intensify its focus on energy resilience, particularly to insulate its missions from the effects of climate change, the MERC program is poised to become the DoD’s central hub for energy resilience project technical assistance and acceleration. The MERC Team submitted a proposal to ESTCP for MERC sustainment (“MERC 2.0”). This MERC 2.0 proposal seeks sustained funding from ESTCP, with a lower fixed budget for programming, in order to further integrate and align MERC with DoD program offices. With this sustained funding, MERC will continue to grow and provide value to energy resilience practitioners within the DoD through more frequent installation-headquarters touchpoints, cross-cutting resilience discussions, and enhanced technical assistance to MERC Cohort members and installations seeking energy resilience projects.

2.2 TECHNOLOGY DEVELOPMENT

2.2.1 Pre-ESTCP MERC Development

The concept for MERC stemmed directly from the experiences of DoD and former DoD energy resilience professionals who articulated a lack of connection to peers across organizational hierarchies and Military Services. The MERC Team recognized that many energy professionals at the installation, program office, and headquarters levels shared common challenges and barriers to innovative project development, and that no community of practice existed to connect and align those professionals to shared solutions development.

In 2017, CSL developed a MERC pilot project (MERC-AF) for demonstration with funding from the U.S. Air Force Office of Energy Assurance (OEA) in partnership with MIT Lincoln Laboratory. Through MERC-AF, CSL developed the Cohort model that it expanded in partnership with ESTCP, as well as Installation Resilience Workshop approaches for facilitated project development acceleration. Three Air Force installations representing active duty, reserve duty, and the National Guard units, were selected to participate in MERC-AF and multi-stakeholder teams successfully completed the program.

In 2018, a team of representatives from CSL, INL, ESTCP, and the energy program offices from each of the Military Services attended the RMI e-Lab Accelerator program in Utah to create the next evolution of the MERC concept. Through e-Lab Accelerator, the team solidified the programming for MERC, including creating the MERC Cohort/MERC Faculty model, clarifying the needs for technical assistance and installation workshops, and cementing the schedule for MERC Major Events.

2.2.2 MERC in 2019

In 2019, the MERC Team recruited and onboarded its first full Cohort of installation energy resilience professionals from the Military Services. MERC hosted its first Major Event at Marine Corps Air Station (MCAS) Miramar, where the MERC Cohort and select MERC Faculty members convened to tour the MCAS Miramar microgrid and the University of California San Diego (UCSD) Energy Innovation Campus. MERC Cohort members also developed their strategic objectives and project plans during their visit to MCAS Miramar, which they continued to work on throughout the year.

MERC Cohort members next convened for a Major Event at FEMP's Energy Exchange in Denver, CO. Each MERC Cohort member was given a customized curriculum with meetings with MERC Faculty members and sessions developed to address their specific challenge or project goal. MERC Cohort members presented their objectives and action plans to the Deputy Assistant Secretary of Defense for Energy Lisa Jung and several other senior DoD energy officials. Finally, MERC Cohort members convened in Washington, DC for the SERDP-ESTCP Symposium, for which the MERC Team created a facilitated "Reverse Pitch" session. During the session, MERC Cohort members delivered short descriptions of their challenges and objectives to technology providers and technical experts, and then participated in collaborative sessions focused on addressing those challenges with the audience on key topics like cybersecurity and energy resilience.

2019 was critical to the MERC program's development and laid the foundation for a sustainable program and community of practice. The MERC Team recruited a Cohort of talented energy resilience professionals, developed, and executed a replicable approach to MERC Major Events, and launched the MERC Online Community. Further, the MERC Team was able to provide technical assistance to DoD policymakers through a) a facilitated working session with the Office of the Secretary of Defense concerning utility engagement, b) an issue paper on the value of resilience in DoD decision-making for OEA, and c) an assessment of the energy resilience requirements of military and civilian emergency management missions at Hanscom AFB.

2.2.3 MERC in 2020

In 2020, the MERC Team created a competitive application evaluation process for selecting the second full MERC Cohort, after receiving more than twice as many applications as 2019. The MERC Team developed an innovative curriculum for its new Cohort, including hosting a new event at the EPRI Electrification Summit, more in-depth technical assistance, and a larger role at Energy Exchange and SERDP-ESTCP Symposium. However, the COVID-19 pandemic shut down all travel and required new approaches for programming.

The MERC Team created a comprehensive program adapting its planned support for the MERC Cohort to the virtual environment. First, the MERC Team conducted needs assessments with each MERC Cohort member, identifying the key objectives they hoped to achieve from the program. Based on these interviews, the MERC Team developed small groups to allow MERC Cohort members to create connections and rapport with others that were pursuing similar initiatives. MERC Team members acted as small group leaders and convened these groups throughout the year for facilitated engagement and support sessions.

Second, the MERC Team created a program of monthly webinars with technical experts and DoD energy senior leaders. These events provided an opportunity to convene the entire MERC Cohort to deliver needed information, and to provide exclusive opportunities for the MERC Cohort to develop professionally- both through learning opportunities and by connecting with senior officials. Finally, the MERC Team adapted many of program offerings and support for MERC Major Events for the virtual environment. MERC developed customized curricula for virtual Energy Exchange, including targeted meetings and exclusive fireside chats with DoD senior energy leaders and technical experts. MERC also created a virtual “Reverse Pitch” session for SERDP-ESTCP Symposium that was attended by more than 75 technology providers and technical experts.

The COVID-19 pandemic and its associated effects in 2020 provided many challenges to MERC, particularly as the program emphasizes direct interaction and connection. However, the MERC Team adapted quickly by completing online facilitation training to deliver meaningful support to the MERC Cohort and achieve its core mission and objectives of strengthening the community of practice for DoD energy resilience professionals. Many of the innovations developed for the virtual environment in 2020 - e.g., the small groups and monthly webinars - will be integrated into standard MERC programming.

2.3 ADVANTAGES AND LIMITATIONS OF THE TECHNOLOGY

MERC encouraged the adoption and diffusion of advanced energy technologies by providing ongoing technical services and increasing the demand for ESTCP deployment opportunities. MERC worked to deliver better, more comprehensive energy resilience projects serving military installation tenants, thereby strengthening mission assurance with the adoption of advanced energy technologies for DoD and the Military Services. The program also strengthened the nascent energy resilience community of practice by expanding the MERC Network, enhancing the Online Community, providing ongoing MERC Network support, and increasing its footprint of activity across the DoD enterprise.

2.3.1 Direct technical assistance through facilitated Installation Resilience Workshops

Advantages

- Tailored to each installation to discover and prioritize the installation’s highest priority resilience needs.
- Connected MERC Cohort members (often Installation Energy Managers) with mission owners and operators, and with installation leadership to generate collective buy-in for energy resilience solutions.

- Provided MERC Cohort members with a report which could be leveraged to justify applications for diverse funding and contracting mechanisms through which they might initiate energy resilience projects.

Disadvantages

- Cost to ESTCP – MERC performers are actively working to align objectives of installation resilience workshops with the objectives of workshops that are needed by Service energy program offices: OEA, the Army Office of Energy Initiatives (OEI), and the Navy’s Energy Security Programs Office (ESPO). This alignment may offer MERC performers the ability to continue workshops in the future as costed options.

2.3.2 Permanent and user-friendly Online Community

Advantages

- Provides resources and the structure required to catalog, store, centralize, and access DoD-relevant energy resilience information such as project reports, tools, policy documents, case studies, discussions, and events.
- Serves as a repository for up-to-date discussions and announcements for a wide range of material, broader than just DoD, concerning energy resilience.
- Facilitates greater understanding and awareness of potential impacts to DoD installations from outside trends and events.
- Communicates a unified voice to the MERC Network and allows for posts and participation from MERC Network members (and beyond) both past and present.

Disadvantages

- Inability to host For Official Use Only (FOUO) information and Controlled Unclassified Information (CUI). Although not an anticipated concern at its inception, the Online Community’s inability to host FOUO information or CUI became a major drawback for many Online Community users. The MERC Team is currently seeking a supplemental secure platform to expand the Online Community. This separate, secure platform will allow for the collection of CUI to enhance the Online Community’s utility, particularly for the MERC Network. The MERC Team will seek an alternate platform to host CUI that specifically addresses the detailed questions and needs of other MERC Network members.

2.3.3 Network of energy-related professionals

Advantages

- Created an energy resilience community of practice which encourages enhanced communication and collaboration, particularly among key project stakeholders who may not have otherwise met or interacted.

- Implemented regular (at least monthly) energy resilience-centered conversations among the MERC Network, keeping energy resilience concerns top of mind for otherwise busy professionals.
- Fostered inter-agency and cross-Military Service collaboration.
- Provided frequent opportunities for professional development and education to equip MERC Cohort members with critical skills and knowledge to drive energy resilience project development at their own installations.

Disadvantages

- Challenges in fully incorporating Pacific Installations – Due to time differences in regular communications and events, as well as significant time for travel to attend MERC events, it was challenging to include interested professionals at Pacific Installations (time zones beyond Hawaii) in the MERC Network. The MERC Team is considering if and how the individuals from these installations might play a role in the MERC Network in the future, even if not as full Cohort members.

3.0 PERFORMANCE OBJECTIVES

MERC efforts have resulted in a more connected, active, informed, and effective DoD resilience community. These outcomes were measured through the tracking of quantitative and qualitative performance objectives outlined in Table 1 below. Actual results are in Section 6.0.

Table 1. Performance Objectives

Performance Objective	Metric	Data Requirements	Success Criteria	Desired Results
Increased energy resilience project activity	Number of active or completed DoD Energy Resilience projects (idea through execution)	Energy resilience project data (prior and current)	Increase in successful project transitions over the MERC Period of Performance (POP)	Increased activity of energy resilience projects ✓
	Number of DoD installations with active or completed energy resilience projects (idea through execution)	Quotes from MERC Cohort members	+4* installations over the MERC period of performance (POP) *Baseline set for first 3 months of MERC POP	
More effective energy resilience professionals	Self-reported value on scale of 0-10 from Cohort members	Survey data collected during Cohort engagement	Average Cohort score greater than 6	More effective energy resilience professionals ✓
Increased MERC Online Community engagement	Number of monthly page views of online community	Online Community use and storage data	30%* increase of each metric over the MERC POP	Increased MERC Online Community engagement ✓
	Number of files, storage size of Online Community, complexity of data architecture		*Baseline set for the first 3 months of fully active deployment.	
Increased demand for MERC Faculty	Number of requests for MERC Faculty inputs	Email tracking	+2* requests increase /year *Baseline set for the first 12 months of MERC POP	Increased demand for MERC Faculty ✓
Increased interest at MERC Network events	Number of Network members that would like to attend events (regardless of ability to attend given schedule/space limitations)	Pre-event interest engagement and attendance rosters	10%* increase/year *Baseline set for the first 12 months of MERC POP	Increased interest at MERC Network Events ✓
Increased demand for Installation Resilience Workshops	Number of requested Installation Resilience Workshops	Email tracking	+2* requests increase/year *Baseline set for the first 12 months of MERC POP	Increased demand for Installation Resilience Workshops ✓
Qualitative Performance Objectives				
Impact/ Assessment of MERC activities by end users	Assessment survey responses from Installation Resilience Workshops Assessment survey responses from Network events Assessment survey responses from the MERC Cohort	Survey (averaging 0-10)	15% increase over the MERC POP for each metric *Baseline set for the first event of each type in the MERC POP	Impact/Assessment of MERC activities by end users ✓

3.1.1 Details on metrics and desired results

Increased energy resilience project activity ✓

- Number of active or completed DoD Energy Resilience projects (idea through execution, associated with MERC)
 - This metric counts the number of Energy Resilience projects associated with MERC which were conducted from idea through execution.
- Number of DoD installations with active or completed energy resilience projects (idea through execution)
 - This metric counts the number of installations with Energy Resilience projects associated with MERC which were conducted from idea through execution.

More effective energy resilience professionals ✓

- Number of DoD installations with active or completed energy resilience projects (idea through execution)
 - Self-reported value on a scale from 0-10 from Cohort members
 - This metric measures the self-described effectiveness of Cohort members in addressing resilience projects. The question posed was “0-10 How much do you agree with the following statement? Because of the MERC program, I can do my resilience work more effectively and efficiently.”

Increased MERC Online Community engagement ✓

- Number of monthly page views of Online Community
 - This metric captures the average monthly page views on the Online Community, which is reported directly from the Online Community hosting service.
- Number of files on the Online Community
 - This metric captures the number of files hosted on the Online Community, which is reported directly from the Online Community hosting service.

Increased demand for MERC Faculty ✓

- Number of requests for MERC Faculty inputs
 - This metric measures the number of MERC Faculty requests the MERC Team receives via email. As a proxy, MERC performers used growth in Faculty size, presented here in end of year numbers. Each year, MERC performers scrub the Faculty list and remove individuals who have moved on from their positions or who are no longer actively contributing to the MERC program. Even with this scrub, the MERC Faculty continues to grow - a trend that MERC performers expect to hold in the future.

Increased interest at MERC Network events ✓

- Number of requests for MERC Faculty inputs
 - This metric gauges the interest in MERC Network events via expressed interest through signing up through an applicant sheet

Increased demand for Installation Resilience Workshops ✓

- Number of requested Installation Resilience Workshops

Impact/ Assessment of MERC activities by end users ✓

- Assessment survey responses from network events.
 - This metric was measured through a series of questions asked after network events which gauged how useful event preparation was, whether the event helped advance the Cohort member's project, how useful the presentations from and meetings with subject matter experts were.
- Assessment survey responses from the MERC Cohort
 - This metric was measured through a series of questions asked at the beginning and end of each Cohort which qualitatively assessed the Cohort member's opinion on how much resilience should be prioritized and how useful they found the MERC program.

4.0 FACILITY/SITE DESCRIPTION

The MERC program was not site specific and instead focused across a broad range of sites. This section summarizes on-site work conducted through the Installation Resilience Workshops and the MERC Network events:

Installation Resilience Workshops: The MERC Team collaborated with the Military Services' energy program offices to identify installations that would benefit from receiving a facilitated in-person or virtual workshop. Each Service provided input through a site selection process which resulted in five installations and one regional planning workshop.

Several factors determined sites that were selected for facilitated workshops:

- The military installation had critical energy requirements, including missions tied to uninterrupted access to electricity;
- The installation was pursuing or considering pursuing resilient energy projects to maintain critical energy requirements during a disruption; and
- Installation leadership and staff committed to fully leveraging the primary MERC tools, providing staff time and access for MERC personnel, and appointing an installation point of contact (POC) for coordinating meetings.

The sites selected for MERC facilitated workshops included a diverse range of military installations at different stages of resilient energy system development and requirements. Locations selected are identified by Military Service below, along with the primary objectives identified for each workshop.

- U.S. Air Force:
 - Kirtland Air Force Base (KAFB) - The objective of the workshop at KAFB was to support the identification of resilience requirements and stakeholder collaboration in preparation for the upcoming Installation Energy Plan (IEP). (2019)
 - Seymour Johnson Air Force Base (SJAFB) - The objective of the SJAFB workshop, which was held virtually due to COVID-19, was to identify project opportunities for a potential partnership with the local utility and to perform resilience requirements identification and stakeholder interviews. (2020)
- U.S. Army:
 - U.S. Army Garrison (USAG) Detroit Arsenal (DTA) - This workshop was identified through a MERC Cohort member. The objective of this workshop was to identify a timeline for multiple projects being executed on the installation, get leadership buy-in, and prepare for future partnerships with DoD, State, and local grant opportunities. (2019)
 - USAG Fort Campbell (FTC) - This workshop was completed virtually due to COVID-19 and supported the development of the Installation Energy and Water Plan (IEWP).

The workshop also aimed to develop potential project opportunities and partnerships. A MERC Cohort member was the POC for this event. (2020)

- U.S. Navy:
 - Regional Pacific Energy Mission Integration Group Meeting (EMIG) - This workshop supported the installations in the Pacific region to identify potential project concepts for integration into the Navy’s EMIG process. (2019)
 - Naval Air Station (NAS) Pensacola - This workshop directly supported a MERC Cohort member to identify the resilience requirements of the mission owners and operators in support of their annual EMIG submission. (2021)

MERC Network Major Events: MERC Network Major Events were held in-person or virtually in conjunction with the FEMP Energy Exchange (Denver, in-person; 2020, virtually) and the SERDP-ESTCP Symposium (Washington, D.C., in-person, 2020, virtually). The MERC Team also held a Site Visit for the entire Cohort at Marine Corps Air Station Miramar to learn about the contractual, funding, and technical processes utilized to develop and install a state-of-the-art microgrid. The Site Visit also allowed participants to tour the University of California San Diego campus microgrid and imagine similar energy resilience projects at their own installations.

4.1 FACILITY/SITE LOCATION AND OPERATIONS

MERC Installation Resilience Workshops were completed at installations identified in Section 4.0. Details about the facility/site location and operations are below.

2019

- USAG Detroit Arsenal
 - USAG - DTA hosts several Defense organizations, including the Tank-automotive and Armaments Command, United States Army Combat Capabilities Development Command Ground Vehicle Systems Center, Development and Engineering Center, Defense Logistics Agency, Army Contracting Command-Warren, Integrated Logistics Support Center, Program Executive Office Ground Combat System and Program Executive Office Combat Support, and Combat System Support. The Detroit Arsenal encompasses 178 acres, with 67 buildings, creating more than 200 million square feet of building space.
- Kirtland Air Force Base
 - KAFB is in Albuquerque, New Mexico. There are over 108 mission partners and tenants all on the installation with unique power requirements and capabilities. The KAFB tenants generally understand their own gaps in energy resilience for critical mission requirements; they rely on traditional resilient energy solutions and continue to explore the impact to the missions that are unable to be relocated during a long-term, high impact outage, which could be caused by natural disasters or determined adversaries.

- The host organization at KAFB is the 377th Air Base Wing. The wing reports to Air Force Global Strike Command. The base and its various mission partners employ about 20,000 active duty, civilians, Air National Guard and Air Force Reserve personnel. The missions of KAFB fall into four major categories: research, development and testing; readiness and training; munitions maintenance; and support to base operations for more than 100 associate units.
- PAC EMIG Workshop
 - The EMIG workshop took place at Pearl Harbor Hickam, HI, and convened representatives and energy teams from the PAC installations that had mission gaps identified through the Navy EMIG process. The Workshop facilitated project concept development and timelines for next steps.

2020

- Fort Campbell (Virtual)
 - FTC is home to the 101st Airborne Division, the 5th Special Forces Group, the 160th Special Operations Aviation Regiment, the 531st Hospital Center, 52nd Ordnance Group and many training and qualification schools and is considered a premier power-projection platform. There are approximately 26,000 military personnel on base and 39,000 family members, making FTC the fourth largest active-duty member population in the Army. The missions of FTC fall into three major categories: readiness and training, deployment of contingency forces, and support to base operations. The MERC workshop aligned and coordinated with ongoing energy resilience efforts at the installation. The IEWP, required by the Army Directive 2020-03 Installation Energy and Water Resilience Policy, focuses on long term strategic investments, and was completed in April 2021.
- Seymour Johnson Air Force Base (SJAFB) (Virtual)
 - SJAFB hosts over 6,000 U.S. Air Force members and their families. SJAFB also employs approximately 1,000 civilian employees and contractors. Each unit on SJAFB has its own unique power requirements and capabilities. SJAFB mission tenants generally understand their own energy resilience gaps for critical mission requirements; they rely on traditional energy resilience solutions (diesel generators) and installation support staff for power during an outage. Installation support staff continue to explore the impact to SJAFB missions in the case that energy cannot or does not reach critical mission tenants in an outage.

2021

- NAS Pensacola
 - NAS Pensacola is located on the Florida Gulf Coast in Escambia County. NAS Pensacola supports the operational and training missions of tenants and enhances the readiness of the U.S. Navy. Major tenant commands include Naval Aviation Schools Command, Naval Air Technical Training Center, Marine Aviation Training Support Group 21 and 23, the Blue Angels, and the headquarters for Naval Education Training Command, a command which combines direction and control of all Navy education and training.

4.2 FACILITY/SITE CONDITIONS

This demonstration was enterprise-wide and took part across a variety of installations and locations (see Sections 4.0 – 4.1). The Online Community was accessible across the entire DoD to MERC Cohort members and Faculty, and Installation Resilience Workshops occurred at specific, targeted locations spanning the continental United States.

5.0 TEST DESIGN

Fundamental Problem: Energy resilience efforts within the DoD were, and still are, numerous, diverse, and largely uncoordinated, and the ability to create an enduring forum for practitioners to connect, hone their skills, learn from one another, and expand implementation was limited. No forums with an emphasis on energy resiliency existed to address this issue.

Demonstration Question: The demonstration sought to resolve whether the MERC multi-pronged approach could increase energy resilience project activity, reduce development time, and raise interest in communal skill-building and project facilitation efforts.

5.1 CONCEPTUAL TEST DESIGN

Hypothesis: The application of facilitated Installation Resilience Workshops, the development of a lasting Online Community, and the creation of an enduring Network were hypothesized to improve the quality of development of energy resilience projects across DoD.

Variables: The specific data collected are detailed in Section 3.0.

Test Design: The MERC Team conducted an array of programming and collected data aligned with program objectives and metrics. Collection methods for the data are detailed in Sections 3.0 and 5.5.

Test Phases: Baseline data was collected until summer 2019. Following this, all data collected was be used for comparative analysis to the established baseline.

5.2 BASELINE CHARACTERIZATION

Baseline Collection Period: Baseline data collection occurred prior to MERC efforts and were derived from data collected during the first 12 months of active deployment of the project.

5.3 DESIGN AND LAYOUT OF TECHNOLOGY COMPONENTS

This section is not directly applicable to the MERC demonstration due to the unique, technology agnostic focus of the project.

5.4 OPERATIONAL TESTING

MERC Year 1 Cohort (2019) - operational testing dates January 2019 - December 2019. Data was sampled as described in the subsequent section. Activities of operational testing included: Cohort initiation, initial Site Visit, FEMP Energy Exchange, and SERDP-ESTCP Symposium.

MERC Year 2 Cohort (2020) - operational testing dates February 2020 - April 2021 (extended due to COVID-19). Data was sampled as described in the subsequent section. Activities of operational testing included: Cohort initiation, monthly webinars, virtual FEMP Energy Exchange, and virtual SERDP-ESTCP symposium.

5.5 SAMPLING PROTOCOL

Data Collectors: INL and CSL recorded data.

Data Description: there are two major sources of data: qualitative and quantitative. Energy resilience project data was derived from existing databases. Online use data came from the NSIN-hosted Online Community. Email tracking, workshop attendance requests, and survey data was compiled by INL and CSL as appropriate.

Data Storage: Data collected to evaluate the MERC program was stored on secure CSL and INL data management platforms. The MERC Team held evaluation data internally and did not share with the larger MERC Network (or beyond) except as rollup metrics or average results. For this project, INL data storage standards meet or exceeds DoD requirements. CSL has provided the DoD with self-attestation for meeting the forthcoming DoD Cybersecurity Maturity Model Certification requirements, Level 3.

Survey Questionnaire: Surveys and questionnaires were distributed routinely and separately to the MERC Network for program evaluation. The MERC Faculty was surveyed twice a year, at the onboarding and offboarding of each MERC Cohort. The MERC Cohort was surveyed at onboarding, offboarding, and immediately after (or at) each MERC Major Event, either virtually or in-person. Surveys were hard copies and electronic and never designed to collect Personally Identifiable Information. Where virtual survey responses were collected, participants were always given the option to send responses securely over email to a member of the MERC Team.

5.5.1 Quantitative Data: Performance Objectives 1, 3-6

0-5 How confident are you that you could get assistance on a resilience project if you needed it?

0-10 How much do you agree with the following statement? Because of the MERC program, I can do my resilience work more effectively and efficiently.

0-10 Did MERC events help to advance project work?

0-10 How useful was site visit to identifying and advancing your project concept?

5.5.2 Qualitative Data: Performance Objectives 2, 7

Technical Assistance: “Thank You Michael! You have created an environment for the technical exchange of information, which hopefully shapes future policy. Being part of the MERC Team has been a wonderful experience.” - 2019 MERC Cohort Member

Facilitation: “I have attended numerous virtual conferences this year, your format was by far the best. I almost didn't sign up as other conference formats have been terrible. The best idea is having the customer do the pitch, to understand their needs.” - 2020 MERC Cohort Member

Virtual Engagement: “Thanks Meredith, MERC has a good experience, even though COVID had a huge impact. Thanks to you, Kirtland Air Force Base (AFB)’s energy resilience will be improved, and I am thankful for being part of that.” - 2020 MERC Cohort Member

Network Creation: “I appreciate all the help and linking of resources this past year from the MERC cadre. Our connections with the National Renewable Energy Laboratory and INL have proven valuable and will certainly help us as we continue progress in construction of our microgrid.” - 2020 MERC Cohort Member

Workshop Support: "MERC helped Ft. Campbell tremendously by conducting our IEWP workshop, and to be honest we would have been lost without MERC's help." - 2020 MERC Cohort Member

Innovation: “MERC is an excellent initiative to bring together "boots on ground" staff with outside entities to understand the problems and evaluate the implementation of current solutions.” - 2019 MERC Cohort Member

5.6 SAMPLING RESULTS

Results sampled during the duration of the project are varied and voluminous. See Appendix B for sample survey results, Online Community user reports, quotes, and anecdotes.

6.0 PERFORMANCE ASSESSMENT

The following section provides a brief overview of the calculations associated with demonstrating that the pre-described performance objectives have been met. Below, the performance objectives are identified, as well as their associated metrics, and the calculations, or raw data related to each metric.

Increased energy resilience project activity

Number of active or completed DoD energy resilience projects (idea through execution, associated with MERC)

Baseline: 0 complete

2019: 16 complete by end of 2019 Cohort

2020: 34 complete by end of 2020 Cohort (total)

Number of DoD installations with active or completed energy resilience projects (idea through execution)

Baseline: 0 installations

2019: 19 installations

2020: 36 installations

More effective energy resilience professionals

Self-reported value on a scale from 0-10 from Cohort members; “Because of the MERC program, I can do my resilience work more effectively and efficiently.”

2019: 9.2/10 (mean)

2020: 9.1/10 (mean)

Increased MERC Online Community engagement

Number of monthly page views

Table 2. Number of Monthly Page Views - MERC Online Community

Month	Number of views 2019	Number of views 2020	Number of views 2021
Jan	30*	194	65 ✓
Feb	402*♦	255 ✓	0
Mar	67*	117	39
Apr	52 ✓	234 ✓	136 ✓
May	83 ✓	401 ✓	N/A
Jun	345 ✓	243 ✓	N/A
Jul	665 ✓	187 ✓	N/A
Aug	1067 ✓	115 ✓	N/A
Sept	480 ✓	132 ✓	N/A
Oct	539 ✓	134 ✓	N/A
Nov	391 ✓	223 ✓	N/A
Dec	278 ✓	221 ✓	N/A

*Baseline performance. Mean = 49 page views/month

♦ Value excluded from mean - value is an outlier due to MERC performers populating and testing site

Number of files on the online community

2019: (50 resilience tools) + (32 technical reports) = 82

2020: (35 policies) + (54 resilience tools) + (9 case studies) + (43 technical reports) = 141

Increased demand for MERC Faculty

- Number of requests for MERC Faculty inputs
 - This original metric was challenging for project performers to gather and verify. Requests for Faculty support could be through an email, a phone conversation asking for connection to a resilience expert, a request to bring Faculty to a Workshop, among others.
 - As a proxy, MERC performers used growth in Faculty size, presented here in end of year numbers. Each year, MERC performers scrub the Faculty list and remove individuals who have moved on from their positions or who are no longer actively contributing to the MERC program. Even with this scrub, the MERC Faculty continues to grow - a trend that MERC performers expect to hold in the future.

2019: 31

2020: 40

Increased interest in MERC Network events

- Number of Network members that would like to attend events (regardless of ability to attend given schedule/space limitations)

2019: 22

2020: 31

Increased demand for Installation Resilience Workshops

- Number of requested Installation Resilience Workshops

2019: 2

2020: 4

Impact/ Assessment of MERC activities by end users. Assessment survey responses from network events.

- Self-reported value on a scale from 0-10 from Network members. “How useful was event preparation?”

2019: 9.3/10

2020: 9.3/10

Whether the event helped advance the Cohort member’s project

- Self-reported value on a scale from 0-10 from Network members. “How helpful was this event to advancing your project?”

2019: 9.3/10

2020: 5.4/10*

How useful were the presentations from and meetings with subject matter experts

- Self-reported value on a scale from 0-10 from Network members. “How useful did you find conversations with subject matter experts?”

2019: 9.4/10

2020: 6.2/10*

*Note that virtual events impacted the value of MERC activities such as virtual FEMP Energy Exchange and virtual SERDP-ESTCP Symposium. Assessment survey responses from the MERC Cohort.

How valuable is the MERC program to MERC Network members

- Self-reported value on a scale from 0-10 from Network members. “I have found the MERC program to be valuable.”

2019: 9.3/10

2020: 9.7/10

7.0 COST ASSESSMENT

This section outlines the cost assessment if the MERC program to be operationalized (i.e., MERC 2.0) at an enterprise-wide level for at the Office of the Deputy Assistant Secretary of Defense for Environment & Energy, and an assessment of the cost benefit of the deployment in sufficient detail for a program manager to assess.

7.1 COST MODEL

The cost model for any future implementation of the MERC Program (MERC 2.0) is based on an assessment of costs and activities in the MERC ESTCP project as well as adjustments (decreasing costs) based on what foundation has been laid and areas identified for continued implementation. The cost model is based on bottom-up forecasting and comparison to MERC ESTCP project costs and activities. The model also considers analogous projects where similar types of installation workshops and technical assistance are offered. As this is not a traditional ESTCP project, there are no specific technology and fielding costs. However, there are labor costs, associated travel costs, and other direct costs associated with the administration for the MERC program. From a cost estimation perspective, the MERC Team assumes that the time MERC Cohort and installation workshop participants is nominal and can be viewed as a job enhancing activity. These are not counted as costs of the project.

The estimated annual cost of the MERC Program, with possible optional additions, is included in the Table below, with a discussion of cost drivers in Section 7.2, and a discussion of cost/benefits in Section 7.3.

Table 3. Cost Model (Annual) Overview for MERC Program or MERC 2.0

Cost Element	Cost	Notes
MERC (Labor)	\$518,435	Core MERC Team labor
MERC (Travel/Other Direct Costs (ODCs))	\$29,912	Core MERC Team Travel/ODCs
MERC- Optional Workshops (Labor)	\$105,500	MERC Team labor for optional workshops
MERC- Optional Workshops (Travel/ODCs)	\$20,430	MERC Team Travel/ODCs for optional workshops

7.2 COST DRIVERS

The primary cost drivers for the MERC program on an annual basis are in the Task Areas described in Table 3 and for optional workshops as described in Table 4. As MERC is an enterprise-wide program, the costs are not specific to any location or Service and are in aggregate across the DoD installation energy community. These costs would adjust over time but provide an estimated cost of enduring implementation.

Table 4. Cost Drivers for MERC Program

Task 1	Create an expanded installation community	\$179,350.08
Task 2	Conduct in-depth engagements at installations (Provide Technical Assistance)	\$147,846.88
Task 3	Sustain and expand the MERC Network	\$188,807.20
Task 4	Increase management touch points through reporting	\$ 29,877.36

Table 5. Cost Drivers for Optional Workshops

Task 2	Conduct in-depth engagements at installations (Design and facilitate Installation Resilience Workshops)	\$125,925.00
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7.3 COST ANALYSIS AND COMPARISON

The total annual cost of the core MERC program is estimated to be \$548,000 per year with the cost of optional workshops estimated to be \$126,000 per year. This is the labor and travel/ODCs expense for the core MERC Team. From a cost estimation perspective, the MERC Team assumes that the time MERC Cohort and installation workshop participants is nominal and can be viewed as a job enhancing activity. These are not counted as costs of the project.

Return on investment is not a straightforward calculation for the MERC program. Based on the performance objectives tracked and discussed in earlier sections and given the current and growing size of energy resilience work at DoD installations, there is anecdotal and quantitative data to support the value of MERC to enhancing the deployment of energy resilience projects throughout the DoD. MERC provides access to a network of peer leaders, opens opportunities to set actionable project goals, and enhances skills development. The Installation Resilience Workshops, noted as an optional add-on in MERC 2.0, were shown to have significant impact on helping translate installation needs into submitted projects and related ESTCP pilots. They are noted as optional add-ons to the program to account for variable and decentralized funding (Office of the Secretary of Defense or Service level) on an as needed or desired basis.

8.0 IMPLEMENTATION ISSUES

Potential implementation issues are limited but cover multiple domains. Below is an outline of two issues and complications which can inhibit end-users from experiencing the full benefit of the MERC program.

8.1 END USER FACTORS

Time and Availability: Cohort members are busy DoD professionals maintaining full-time jobs as Installation Energy Managers, project managers, community outreach specialists, among others. Cohort members were frequently fulfilling more than one role at their installation during the project due to staffing constraints. As such, Cohort members sometimes faced competing priorities which hampered their full engagement in MERC program activities.

Frequent turnover: Energy resilience-related positions at DoD installations see high turnover. There were several instances in which Cohort members changing roles or jobs partway through the Cohort tenure, and found continued engagement in MERC challenging given the demands of their new role.

APPENDIX A POINTS OF CONTACT

POINT OF CONTACT Name	ORGANIZATION Name Address	Phone E-mail	Role in Project
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APPENDIX B ARCHIVED RESULTS

Below are example samples of archived results of the MERC project.

Sample survey results:

First Name	Last Name	Email	Q1 - What else do you wish that you had prior to ESTCP Symposium? What would have made you feel more prepared?	Q2 - On a scale of 0 to 10, did MERC events at ESTCP Symposium help to advance your project work?	Q2 - Additional Feedback	Q3 - Is there additional material or support that you would have found helpful to make ESTCP Symposium more productive? If so, please describe:
REDACTED	REDACTED	REDACTED		8		NA
REDACTED	REDACTED	REDACTED	My first Symposium. At this time I don't have input. I felt very prepared and enjoyed the event!	9	9 at this time. The follow-on with the contacts I met will make this a 10!	Maybe more advance notice on the capability to attend a short course. Very nice to be allowed to attend, although I did not participate. Others did.
REDACTED	REDACTED	REDACTED	Nothing. I was fully engaged with an IEP site visit to Peterson and Cheyenne Mountain during November. I wouldn't have had time to prepare.	8		
REDACTED	REDACTED	REDACTED	An overview of what the Symposium is. Essentially as an operator, framing our energy community and meetings helps facilitate interactions	10	Reconnecting with touch points to work on mission integration is huge. There is substantial value in face-to-face communication. It was great seeing the MERC Cohort work resolution in their own project friction points.	See #1
REDACTED	REDACTED	REDACTED	More info sooner about the reverse pitch. I was still unclear when I arrived.	7		The app was not available to me.
REDACTED	REDACTED	REDACTED	More time to review associated information on the website	5		
REDACTED	REDACTED	REDACTED		10		Follow on videos
REDACTED	REDACTED	REDACTED	A list of ESTCP projects and status	8	CY2019 was a big year for awareness and visibility of energy security issues at my installation. This was largely in part due to the support from the MERC community.	Same answer as #1 - helps an energy manager understand the portfolio of work currently ongoing.
REDACTED	REDACTED	REDACTED		8		None
REDACTED	REDACTED	REDACTED	More specific info on what it was	7		More info on the audience for the Reverse Pitch
REDACTED	REDACTED	REDACTED		8		
REDACTED	REDACTED	REDACTED				
REDACTED	REDACTED	REDACTED				

Q4a - List the 3 parts of ESTCP Symposium that you found to be the most valuable.	Q4b - List the 3 parts of ESTCP Symposium that you found to be the most valuable.	Q4c - List the 3 parts of ESTCP Symposium that you found to be the most valuable.	Q5a - What are the top 2 key takeaways from ESTCP Symposium related to your project?
Discussion on relevant topics with other members	Meeting & receiving help from industry	Discussion at reverse pitch	Help is available
The Reverse Pitch Session!	The room to breathe. Not as crowded as EEx.	Access to many top officials.	Many folks asking for the same need as I am.
Assistance provided with the 2-minute Reverse Pitch. Will be useful in many other situations.	Energy resilience sessions	Interacting with MERC staff and peers	Knowing other bases (Langley) are working similar projects.
Listening to solution directly from providers	Face-to-face relationship building	Learning we all experience same problems with different perspectives	We all have common problems but @ different points in project
RMF morning session with Mike	Discussion of the Online Community website	Having an HQ room; surveys!	POCs for future resources
Reverse Pitch roundtable session	Preparation activities for the Reverse Pitch	RMF short course	Need to reach out to POCs met/referenced for expediting ESPC ATO
Reverse Pitch roundtable session	Navigating RMF	#1 Resilience Demonstration	Lawyers - contacts from K Hammack support offer from McGhee
Reverse pitch	Energy resilience panel	Connecting with industry and technology leaders	Microgrid solutions need a robust and informed team of professionals
Exhibits - poster sessions	Collaboration	Pitch	Technology demonstration
Reverse Pitch	Posters	Tech sessions	Everyone is still learning
Reverse Pitch	Collaboration	Posters	Need technology approval at DoD/AFCEC level

Q5b - What are the top 2 key takeaways from ESTCP Symposium related to your project?	Q6 - How much do you believe energy resilience should be prioritized?	Q6 - Additional Feedback	Q7 - How confident are you that you could get assistance on resilience projects if you needed it?
There are other people trying to solve the same problems	4		3
Good collaboration from folks that have answers.	4	4 as day-to-day reliability and routing disruptions should be and are my 5.	5
RMF issues	4		5
A forum to debrief success stories and failures to better grow projects would be huge	4		5
Connections to RMP support contractors	4		4
Need to develop a strategy for addressing cybersecurity	5		3
Access to Mike Chipley	5	Marked as 11	2
	5		4
Funding is available	4		3
Find already demonstrated technology	4		4
Standardized information dissemination	5		4
	4	I believe all utility resilience should be prioritized - to include water, NG, fuels, and wastewater	5
	4		4

Q7 - Additional Feedback	Q8 - What do you see as the greatest barriers to implementing resilience solutions? (Select all that apply)	Q8other - Please specify:	Q8 - Additional Feedback
	b,c,f		
	a,g	Many resilience solutions are basic probability problems.	
	f,g	Energy management PD's do not reflect the changes in priorities. PD's still focus on efficiency/cost savings.	
	a,e		
	b,c,d,e,f		
	a,b,c,d,e,f		
	a,b,c,d,e,f,g	Small installation/low priority	Dead wood -> Don't move my cheese; RMF support :(
	a,b,c,d,e,f		Energy resilience has simply not been prioritized in recent years, creating a culture of complacency
	a,d		
	c,d		
	c,d,e		
	a,b,g	See additional feedback	1) The perception at higher HQ levels that advanced resilience is commonplace and easily implemented. It is not. 2) Calculation of return on investment.
	c,f		

Q9 - How often do you participate in resilience network conversations and/or meetings?	Q9 - Additional Feedback	Q10 - Do you use any metrics to measure resilience?	Q10 - Additional Feedback
3		No	
4	EMIG/MAA/Other items, Wally, Utility Privatization	Yes	
4		No	
2		Do not know	
2		Yes	Working with our UP provider on these metrics. In development.
3		Yes	Installation energy generation capability (MW)
5		Yes	
3		No	Lots of discussion; no formal metrics
3	Actively with community and city officials	No	
4		Yes	
2		Do not know	
3		Yes	At MCB Camp Lejeune, resilience is mainly "measured" by destructive weather recovery. Some of that is objective, some subjective.
4		Yes	The Navy has Energy Mission Integration Group (EMIG) and Gap Analysis. The theory behind this is solid, but the execution method (a dunky, hastily built website that does not provide anything that is brief-able to senior leaders) is a poor as anything I have ran into in 17 years of federal service.

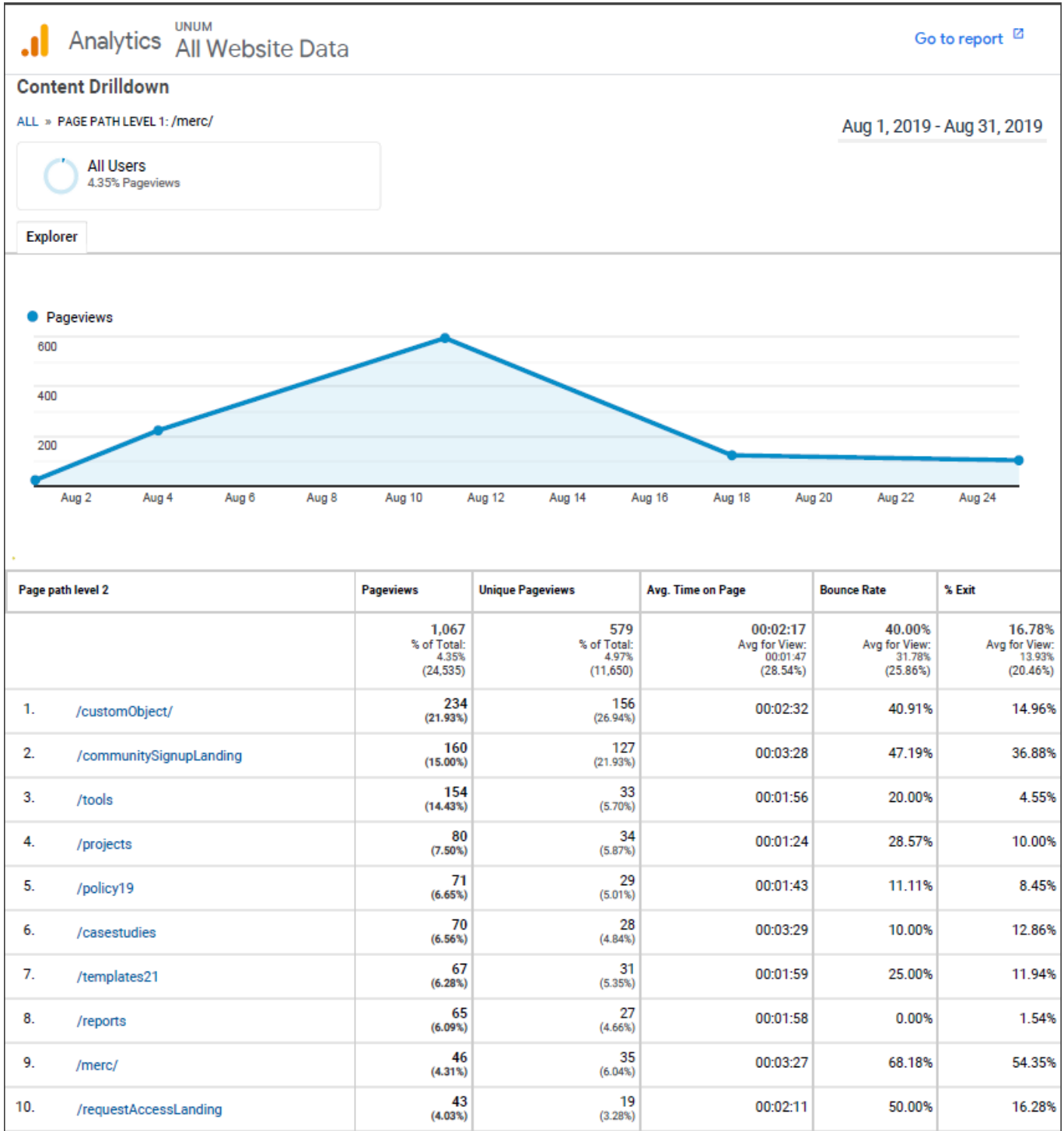
Q11 - Where do you most need assistance in executing resilience projects? (Select all that apply)	Q11other - Please Specify:	Q11 - Additional Feedback	Q12 - Where do you feel that your Service branch can most improve? (Select all that apply)
a,b,d			a,d,f
g	Buy-in and an identified execution team with the right participants.		b
f,g	Manpower	My "legacy" energy management responsibilities still consume most of my time. (Billing, reporting, AEMRR's, data calls.) Championing my Wing's efforts to improve resilience is a full-time job itself.	e,h,
a			c,g
d,e			d,g
a,b,c,d,e,f			a,d,i
b,c,d,e			a,c,d,e,g,h
a,c			a,b,c,d,e,f,g,h
a,g		I partner with community on joint land use study and coastal energy resiliency is part of the city plan. It would be beneficial to determine if we could partner together to execute demonstration projects.	b,c,f
a,d,f			c,d,g
a,d			c,d,e,f
a,c,d		a - It is changing quickly; c - how do we maintain it?; d - calculation of ROI	b,e,i
c,d,e			a,d

Q12other - Please Specify:	Q12 - Additional Feedback	Q13a - How much do you agree with the following statements? I have found the MERC program to be valuable.	Q13b - How much do you agree with the following statements? Because of the MERC program, I can do my resilience work more effectively and efficiently.
		9	8
	Energy and utility SME's working together.	10	10
		9	10
		10	10
	Resilience is a tacked-on priority. Other duty as assigned? Gets dropped on the EM as the most invested party.	9	9
Devoting personnel/resources/training		8	8
	g -Forcing; h - meters	10	10
		10	10
		9	9
		10	9
		9	8
Understanding technical implementation		9	9
		10	10

Q13 - Additional Feedback	Q14a - What does the MERC program do well?	Q14b - What does the MERC program do well?	Q14c - What does the MERC program do well?
	Facilitate discussion	Bring together experts to solve problems	Gather resources
	Great MERC team, very prepared, productive time	The Peer-to-peer Network	Access to top officials/faculty
	Guided discussions/activities were great at focusing/addressing important issues in my project.		
I can better understand how energy is operationalized and communicate with my experts. Solid 10 at my last duty station.	Facilitate cross-talk among all interested parties	Break down community problems to facilitate solutions	Expanding solutions beyond one specific application
	Networking - getting people talking	Technical expertise - website and finding POCs	Explaining its goals and motivations
	Challenging participants to engage with others	Prepping participants for activities	Spreading awareness of applicable sessions
	Provide access to institutional resources	Remove institutional silos	Access to leaders to provide 1st Hand requests/concerns
	Provides clear direction based on facts	Supports energy champions regardless of background	Provides a forum for energy managers and leadership to have meaningful discussions
	Facilitation	Collaboration	Providing
	Networking	Communication	Disseminating information
	Provide collaboration opportunities	Access to tech providers that are firewalled out at the moment	Provide solutions avenues
I built relationships	Bring people together	Stimulate conversations	Build relationships
	Provide connections with Senior Leaders	Provide connections with Industry	Provide connections with colleagues; Fills a void that neither a service nor the DoD is providing with a forum to discuss resilience issues.

Q14a - What does the MERC program do well?	Q14b - What does the MERC program do well?	Q14c - What does the MERC program do well?	Q16a - Anything else you'd like to say about MERC? You can quote me saying:
Facilitate discussion	Bring together experts to solve problems	Gather resources	MERC is where you learn, solve problems, help other people, and have fun!
Great MERC team, very prepared, productive time	The Peer-to-peer Network	Access to top officials/faculty	All good
Guided discussions/activities were great at focusing/addressing important issues in my project.			
Facilitate cross-talk among all interested parties	Break down community problems to facilitate solutions	Expanding solutions beyond one specific application	MERC has shifted my mission focus to understand that utilities are a mission domain. It is important that I bring my experts into the operational family.
Networking - getting people talking	Technical expertise - website and finding POCs	Explaining its goals and motivations	It was a great experience all around. All the people were wonderful. Motivated, pleasant to deal with and genuinely wanted to be helpful.
Challenging participants to engage with others	Prepping participants for activities	Spreading awareness of applicable sessions	MERC is a great opportunity to engage with peers and leaders in the industry to find answers to the questions we all have!
Provide access to institutional resources	Remove institutional silos	Access to leaders to provide 1st Hand requests/concerns	The most valuable use of my limited time to help navigate energy resilience challenges.
Provides clear direction based on facts	Supports energy champions regardless of background	Provides a forum for energy managers and leadership to have meaningful discussions	I appreciate "catalyst" being used in the title. MERC has absolutely been a catalyst for awareness and visibility at Kings Bay.
Facilitation	Collaboration	Providing	MERC has provided a forum to energy collaboration and venue to cross-talk amongst services and DoD enterprise-wide.
Networking	Communication	Disseminating information	Great job, leadership should pay attention to this work.
Provide collaboration opportunities	Access to tech providers that are firewalled out at the moment	Provide solutions avenues	#MERCmoments; "Another survey?"
Bring people together	Stimulate conversations	Build relationships	
Provide connections with Senior Leaders	Provide connections with Industry	Provide connections with colleagues; Fills a void that neither a service nor the DoD is providing with a forum to discuss resilience issues.	"Being a MERC Cohort was a tremendous experience for me. I have been in the federal energy management field, either full-time or part-time for the last 12 years. MERC opened my eyes to federal and state funding mechanisms that I did not know existed. Recommend this program to energy professionals without reservation!"

Sample Online Community User Report:



Sample of Anecdotes and Quotes:

Technical Assistance: “Thank You Michael! You have created an environment for the technical exchange of information, which hopefully shapes future policy. Being part of the MERC Team has been a wonderful experience.” - 2019 MERC Cohort Member

Facilitation: “I have attended numerous virtual conferences this year, your format was by far the best. I almost didn't sign up as other conference formats have been terrible. The best idea is having the customer do the pitch, to understand their needs.” - 2020 MERC Cohort Member

Virtual Engagement: “Thanks Meredith, MERC has a good experience, even though COVID had a huge impact. Thanks to you, Kirtland Air Force Base (AFB)’s energy resilience will be improved, and I am thankful for being part of that.” - 2020 MERC Cohort Member

Network Creation: “I appreciate all the help and linking of resources this past year from the MERC cadre. Our connections with the National Renewable Energy Laboratory and INL have proven valuable and will certainly help us as we continue progress in construction of our microgrid.” - 2020 MERC Cohort Member

Workshop Support: “MERC helped Ft. Campbell tremendously by conducting our IEWP workshop, and to be honest we would have been lost without MERC's help.” - 2020 MERC Cohort Member

Innovation: “MERC is an excellent initiative to bring together "boots on ground" staff with outside entities to understand the problems and evaluate the implementation of current solutions.” - 2019 MERC Cohort Member