
CampusEnergy2021
BRIDGE TO THE FUTURE
Feb. 16-18 | CONNECTING VIRTUALLY
WORKSHOPS | Thermal Distribution: March 2 | Microgrid: March 16

Enhancing Mission through Energy Assurance

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HDR

INTERNATIONAL DISTRICT ENERGY ASSOCIATION

Q&A Will Not Be Answered Live

Please submit questions in the Q&A box.
The presenters will respond to questions off-line.

Campus Environments are the Backbone of the Infrastructure we Count on

They Support our Heath

They Educate our Children

They all Require Energy to Operate

They Provide Entertainment

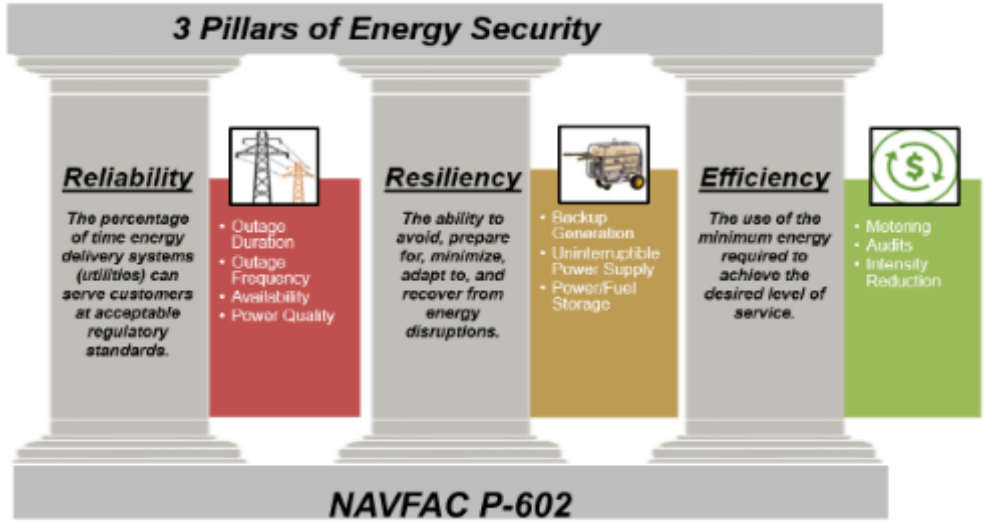
They Provide Goods and Services

They Protect our Way of Life

How do we Assure the Energy needed is Available?

1. **Energy Assurance – DOD Perspective**
2. **Air Force Evaluation Methodology**
3. **Hazard and Threat Analysis**
4. **Application of Resilient Strategies**
5. **Mission Scorecard**
6. **Broad Process Value**

Energy Assurance – A DoD Agency Perspective



Air Force Energy Strategic Goals

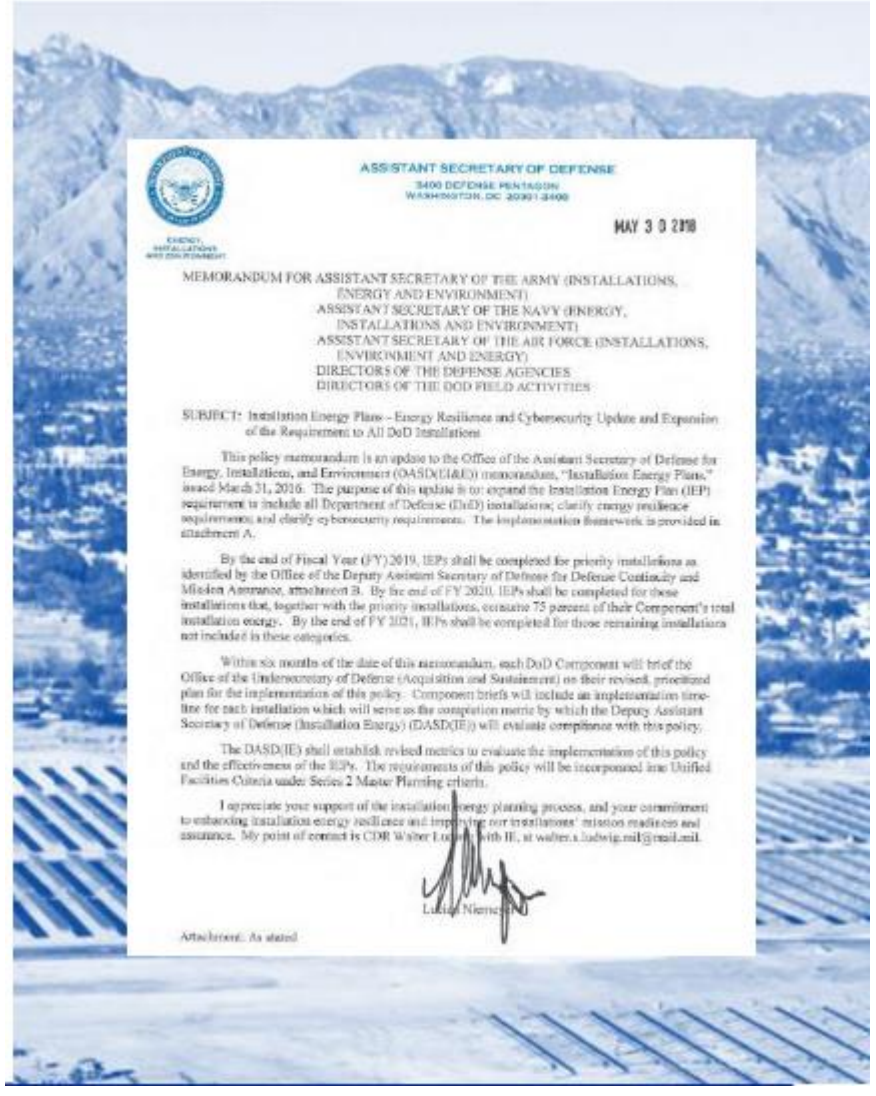
Goal	Intent	Expected Outcome
1. Improve Resiliency	– Identify vulnerabilities to energy supplies, such as physical and cyber attacks or natural disasters – Mitigate impacts from disruptions in energy supplies to critical assets, installations, and priority missions – Develop ability to prioritize resources against risks to the mission – Advance physical and cyber security solutions to protect critical energy assets and secure industrial controls systems	– Improved responsiveness to disruptions to energy supplies – Increased ability to quickly resume normal operations and mitigate impact to the mission – Prioritized response plans and solutions to mitigate risks from the tail (logistics supply chain) and the tooth (energy demand in operations) – Assured ability to provide energy for mission-critical function
2. Optimize Demand	– Increase energy efficiency and operational efficiency for Air Force systems – Enhance capabilities by focusing on the energy required to achieve the Air Force mission – Build energy considerations into Air Force research, development, test and evaluation (RDT&E) efforts	– Decreased amount of energy required by Air Force systems and operations without negative mission impacts – Increased flexibility, range, and endurance in all operations – Matured long-term, focused solutions to Air Force energy challenges
3. Assure Supply	– Integrate alternative sources of energy compatible with mission requirements – Diversify drop-in sources of energy – Increase access to reliable and uninterrupted energy supplies	– Access to clean energy resources and supply chains based on asset and mission priorities – Increased flexibility in all operations – Increased ability to sustain mission

What is Energy Assurance?

- Activities focused across three main categories to prepare for physical, natural and cyber threats
  - Preparation and Planning
  - Mitigation and Response
  - Education and Outreach
- All are focused on the goal of **energy resiliency** - the ability to prepare for and recover from energy disruptions that impact mission assurance on military installations

DoD Energy Assurance Requirements

- **REQUIREMENT**: March 2016, OSD issued a memorandum requiring development of Installation Energy Plans (IEPs) at all DoD installations
- **PURPOSE**: To create a decision-making framework to assist in achieving an installation's energy goals and connect planning to operations
  - Incorporate long-range plans for energy resilience capabilities
  - Ensure available and reliable utilities for each installation's critical missions
  - Define energy requirements for the mission



ASSISTANT SECRETARY OF DEFENSE
3400 DEFENSE PENTAGON
WASHINGTON, DC 20301-3400

MAY 3 0 2018

MEMORANDUM FOR ASSISTANT SECRETARY OF THE ARMY (INSTALLATIONS, ENERGY AND ENVIRONMENT)
ASSISTANT SECRETARY OF THE NAVY (ENERGY, INSTALLATIONS AND ENVIRONMENT)
ASSISTANT SECRETARY OF THE AIR FORCE (INSTALLATIONS, ENVIRONMENT AND ENERGY)
DIRECTORS OF THE DEFENSE AGENCIES
DIRECTORS OF THE DOD FIELD ACTIVITIES

SUBJECT: Installation Energy Plans – Energy Resilience and Cybersecurity Update and Expansion of the Requirement to All DoD Installations

This policy memorandum is an update to the Office of the Assistant Secretary of Defense for Energy, Installations, and Environment (OASD(EI&E)) memorandum, "Installation Energy Plans," issued March 31, 2016. The purpose of this update is to: expand the Installation Energy Plan (IEP) requirement to include all Department of Defense (DoD) installations; clarify energy resilience requirements; and clarify cybersecurity requirements. The implementation framework is provided in attachment A.

By the end of Fiscal Year (FY) 2019, IEPs shall be completed for priority installations as identified by the Office of the Deputy Assistant Secretary of Defense for Defense Continuity and Mission Assurance, attachment B. By the end of FY 2020, IEPs shall be completed for those installations that, together with the priority installations, consume 75 percent of their Component's total installation energy. By the end of FY 2021, IEPs shall be completed for those remaining installations not included in these categories.

Within six months of the date of this memorandum, each DoD Component will brief the Office of the Undersecretary of Defense (Acquisition and Sustainment) on their revised, prioritized plan for the implementation of this policy. Component briefs will include an implementation timeline for each installation which will serve as the completion metric by which the Deputy Assistant Secretary of Defense (Installation Energy) (DASD(IE)) will evaluate compliance with this policy.

The DASD(IE) shall establish revised metrics to evaluate the implementation of this policy and the effectiveness of the IEPs. The requirements of this policy will be incorporated into Unified Facilities Criteria under Series 2 Master Planning criteria.

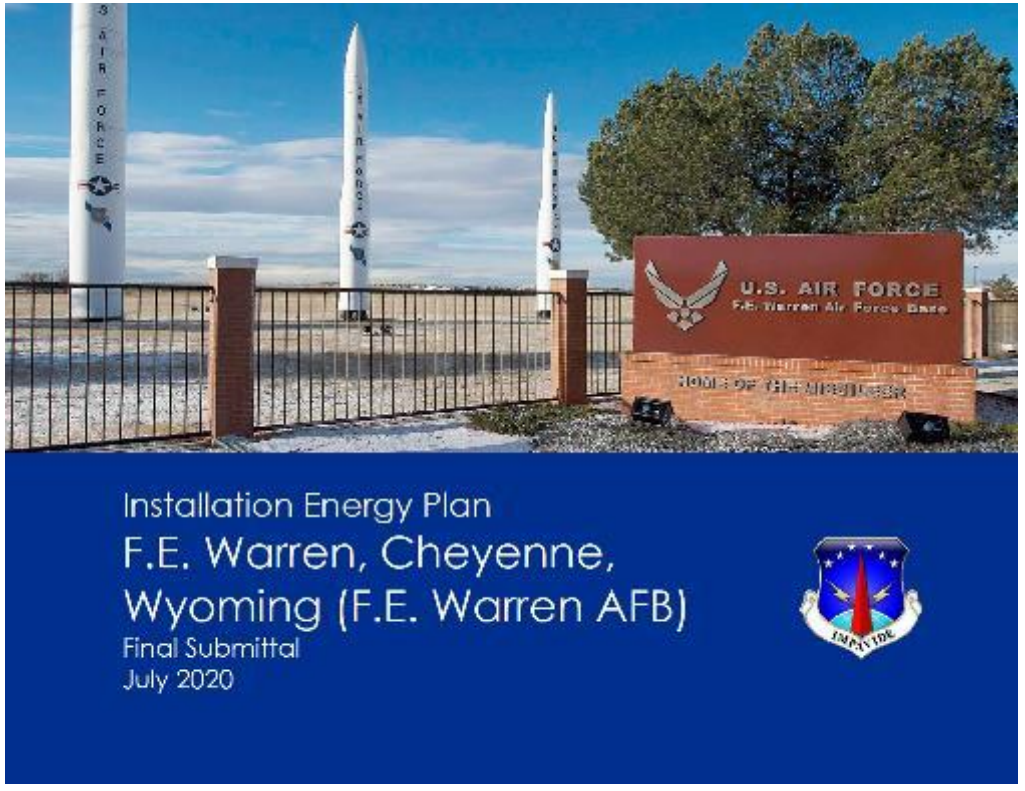
I appreciate your support of the installation energy planning process, and your commitment to enhancing installation energy resilience and improving our installations' mission readiness and assurance. My point of contact is CDR Walter Ludwig with IE, at walter.s.ludwig.mil@mail.mil.

Attachment: As stated

Approach to Installation Energy Plans

GOAL: Meet current and future demands to achieve mission assurance through energy assurance while integrating cybersecurity requirements into planning strategies by asking the following:

- Where are you now? (Baseline)
- What do you need to protect? (Requirements)
- How do you protect the mission? (Strategies)
- What are alternatives? (Scenario Development)
- How to make that happen? (The Roadmap)
- How do you communicate the plan? (Integration with Installation Development Plan)



Air Force IEP Development Roadmap

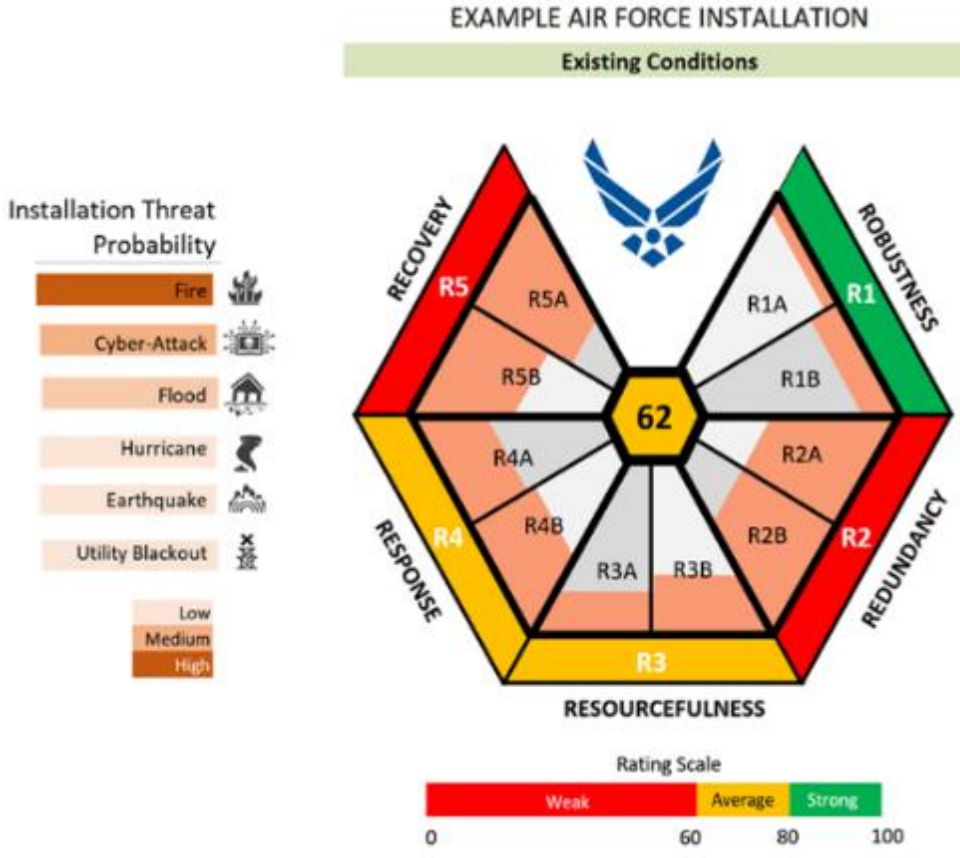
ENABLING RESILIENCE: Installation Energy Plans (IEPs) enable resilience by:

- Acting as a resource advocacy tool
- Aligning infrastructure requirements and investments to meet mission capability
- Ensuring airbase resiliency

BENEFIT: Installations are able to protect, respond, and recover from disruptions that degrade operations, allowing survivability, resiliency, and redundancy

The Evaluation Process

- The Air Force developed a standardized framework and assessment tool focused on mission requirements as they apply toward the 5 R's



RESILIENT ENERGY + WATER PERFORMANCE

R1 ROBUSTNESS
How robust are the energy+water systems on installation?
R1A Cybersecurity of Energy Systems
R1B Physical Hardening / Protection of Critical Assets

R2 REDUNDANCY
Are there redundant systems and alternate sources to avoid single points of failure?
R2A Single Points of Failure in Energy + Water Systems
R2B Energy & Water Source Diversity

R3 RESOURCEFULNESS
Is energy efficiently managed and delivered?
R3A Energy & Water Intensity (Demand) Reduction
R3B Energy & Water O&M Manpower & Skillsets

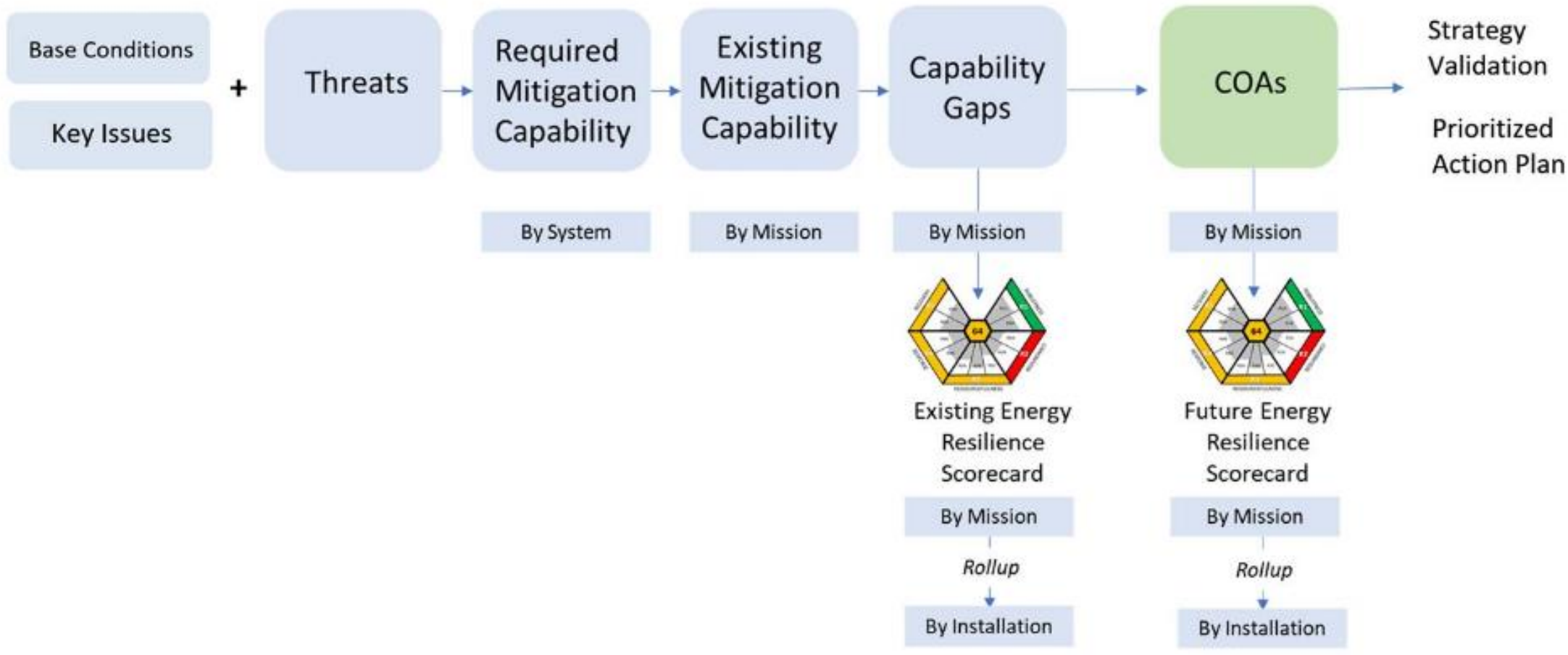
R4 RESPONSE
Is the installation prepared to respond to emergency/disruptive event?
R4A Emergency Management Protocols for Energy+Water Systems
R4B Critical Loads with Island / Backup Mode Operations

R5 RECOVERY
How long can critical mission functions be sustained in emergency mode?
R5A Critical Loads Sustainment Capacity (Fuel/Energy+Water Storage)
R5B Reliability of Emergency Energy & Water Systems & Operations

R1, R2 and R3 categories focus on the capability of the existing infrastructure if an event occurs

R4 and R5 categories focus on response and recovery capabilities if/when an event occurs

Resiliency Assessment Approach



Hazards and Threats Analysis

Installation Level

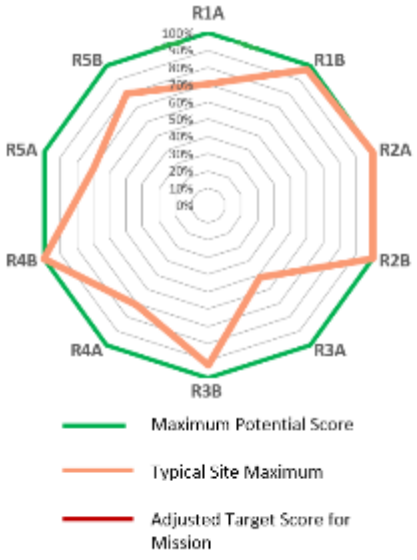
- Determine probability and severity of threats
- Assess threat consequences
- **Result**: Establishes target resiliency score specific to overall installation

THREATS

	Probability	Severity
Earthquake	Occasional	Critical
EMP	Rarely	Critical
Environmental Corrosion	Rarely	Negligible
Flooding - Major	Seldom	Moderate
Flooding - Minor	Occasional	Moderate
High Winds	Frequent	Critical
Lightning	Frequent	Moderate
Malicious - Cyber	Occasional	Moderate
Malicious - Physical	Seldom	Moderate
Tsunami	Rarely	Negligible
Utility Blackout	Occasional	Critical
Volcanic Eruptions	Rarely	Negligible
Wildfire - Major	Seldom	Moderate
Winter Storm	Seldom	Moderate

THREAT CONSEQUENCES

	Degree of Concern	Recommended
Source : Loss of Primary Sources	Moderate	Moderate
Supply Logistics : Disruption / Failure	Moderate	Moderate
Transmission : Failure / Loss	High	Moderate
Distribution : Failure / Loss	High	High
Controls : Loss of Access	Low	Low
Communications : Breakdown / Unavailable	High	Low
Manpower : Unavailable / Inaccessible	Moderate	Moderate
Equipment : Damaged / Inoperable	High	Low



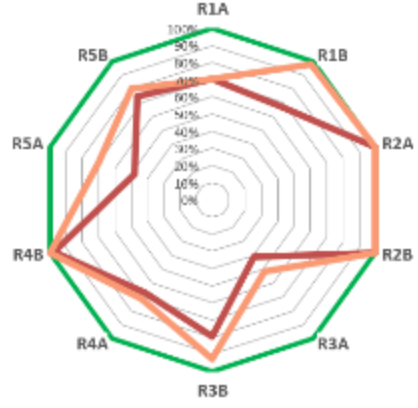
Mission Level

- Assess resource availability requirements
- Assess minimum contingency requirements
- **Result**: Establishes target resiliency score specific to mission

Resource	Availability Requirements	Min Contingency
Power	Uninterruptible	2N+1
Fuel	7 Day Supply	N+1
Heat	Essential	N
Cooling	Non-Essential	N+1
Water	No Requirement	na
Communications	Essential	N
Personnel	Essential	N+1

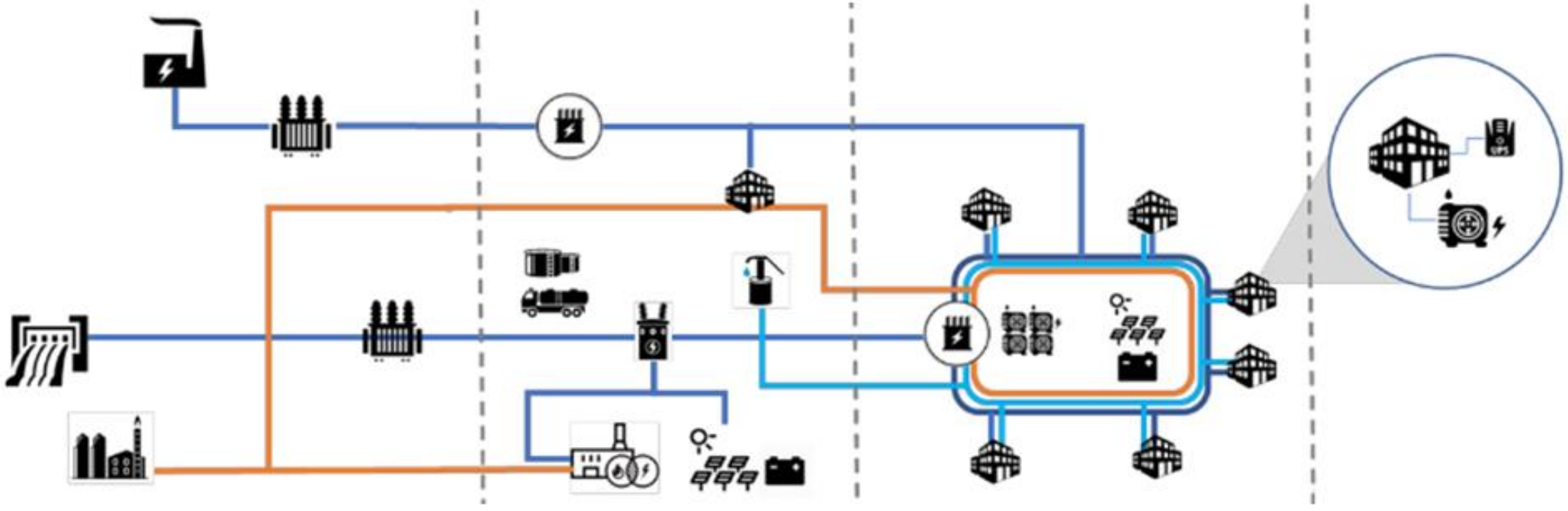
Is Mission Relocatable?

No



Application of Resiliency Strategies

Off-Site	Installation	District	Building
Strategies applicable to the utilities serving the installation (source of supply, capacity, transmission capabilities and outage history)	Strategies applicable to the entire installation (substations, water treatment facilities, site distribution)	Strategies applicable to geographically distinct areas within the installation (district microgrids, heating/cooling plants)	Strategies applicable for mission critical buildings (back-up generation, efficiency measures)



Application of Resiliency Strategies

SCALE	CATEGORY	STRATEGY NAME	Weight	5Rs										RESOURCE				STRATEGY DESCRIPTION
				R1A	R1B	R2A	R2B	R3A	R3B	R4A	R4B	R5A	R5B	POWER	WATER	HEATING	COOLING	
Building	Power Distribution	Adequate Electrical Circuit Condition (Building Level)	2		X				X					•				A facility may have inadequate electrical circuit condition if areas within the building face repeated circuit breaker openings or exhibit other power reliability issues, including fire concern. Repairing electrical circuits in poor condition improves reliability and reduces the likelihood of mission
Building	Building Systems	Alternate Heat Generation (Building Level)	2				X		X							•		Diversifying the heating fuel source reduces reliance on a single supply line. This strategy is installing or upgrading building heating systems to work with multiple fuels. Example is installing an electric heating element or boilers that can work on both natural and propane gas.
Building	Backup Power	Backup Power for Critical Loads (Building Level)	5				X		X		X			•				Installing backup systems to ensure supply failure does not compromise an uninterruptable critical asset/function.
Building	Water	Backup Water Supply (Building Level)	3				X		X						•			If the main water utility supply to the facility fails, having a backup means to supply water can avoid a loss of mission function. This is especially true for facilities with critical water demands. Examples include local storage tank, secondary water pipe, or water buffalo connection.
Building	Controls and Communications	Building Systems Monitoring	3	X						X				•	•	•	•	The monitoring of a building's energy system performance allows localized response to issues and optimization opportunities. This can highlight compromised equipment and reduce resource consumption.
District	Building Systems	Cooling System Capacity (District Level)	2					X	X								•	Increasing the redundant capacity of a centralized cooling system to increase the available supply when there is a localized equipment fault.
District	Power Distribution	District Microgrid	5			X	X		X		X			•				The U.S. Department of Energy defines a microgrid as "a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid. A microgrid can connect and disconnect from the grid to enable it to operate in both grid-connected or island-mode." This strategy considers configuring a district within an installation into a microgrid, enabling greater functionality and more efficient use of resources to continue operations during a utility power outage. A microgrid requires appropriate cybersecurity measures.
District	Building Systems	Thermal Energy Storage (District Level)	2				X		X							•	•	Thermal energy storage, such as ice, chilled water, or hot water storage, can provide backup supply during an outage. It can also be used to reduce peak load and save energy costs and reduce the design requirements for primary and backup power, helping the facility reach its required sustainment capacity. Applied at a district level this would be at a central cooling plant.
Installation	Power Distribution	Adequate Electrical Transmission Condition (Installation Level)	3		X	X			X					•				An installation's power transmission system may be in inadequate condition if sections of the system face repeated failure or reliability issues. Bringing the transmission system into adequate condition may include replacing aging (especially wooden) poles, replacing aging lines, or undergrounding lines where appropriate, thereby mitigating risk of fire, wind, wildlife, or physical damage.
Installation	Power Distribution	Alternate Substation Connection	5			X			X					•				This strategy considers connecting the base electrical distribution infrastructure to an alternative substation, whether the substation is existing or built specifically for this purpose. By connecting to an alternative substation, utility supply can be ensured if there is a failure in the primary substations.
Installation	Energy Supply	Alternate Supply Paths (Natural Gas)	3			X								•		•		A single point of failure in the natural gas supply means failure at one point causes disruption to all demand downstream. Installing natural gas lines in a looped configuration would allow gas supply to be rerouted to mitigate point failure. At the installation level, this includes multiple mains from the natural gas source. At the district level, this includes looped pipes downstream from any pressure-reducing stations that may be on base.
Installation	Power Distribution	Alternate Supply Paths (Power) (Installation Level)	4			X								•				A single point of failure in the power distribution means failure at one point causes disruption to all loads downstream of it. At an installation level this can be a single substation transformer or transmission line. Mitigation may require looping all distribution lines that come from the district substation, providing redundant feeders and distribution equipment, and using other strategies that enable alternate routes for power supply whenever an element of the transmission/distribution system fails.
Installation	Water	Backup Power for Lift Stations (Storm/Sanitary Sewer)	1						X	X					•			If the installation relies on lift stations for storm and/or sanitary sewer distribution (e.g., not gravity fed), sewers can begin to back up during a power outage if the lift stations do not have backup power supply. Backup power can sustain lift station operation through an outage.
Installation	Energy Management	Energy Management and Control Systems (Installation Level)	3					X			X			•				Installing an EMCS allows monitoring and control of energy systems at the building level at every major facility on the installation. This can enhance response time to system issues and increase sustainment time by curtailing non-critical loads.
Off-site	Water	Alternate Wastewater Connection	3				X								•			An alternative domestic wastewater connection includes a connection to a nearby municipal wastewater treatment system. For installations relying exclusively on on-base treatment systems, this strategy can ensure access to wastewater treatment.
Off-site	Energy Supply	Alternate/Renewable Energy Generation (Off Site)	1				X				X			•				This is a strategy to leverage near-site alternative generation capacity to provide an additional power supply source that can be sustained in the event of an outage. An example is the use of a landfill-gas generator located on an adjacent landfill.
Off-site	Other	Contractor Emergency Availability Protocol (Energy)	3							X				•	•	•	•	If some or all of an installation's energy infrastructure is privatized, the contract or other supporting documentation should include provisions for the contractor's responsibility in cases of emergency. Examples include specified response times to failures or priority status in responding to disasters.
Off-site	Water	Off-site Domestic Water Connection	3				X		X						•			An off-site domestic water connection includes a connection to a nearby municipal supply, especially when paired with a well field potable water supply, which can improve the water supply availability for the installation.
Off-site	Energy Supply	Redundant Fuel Supply Routes (Off Site)	4			X								•	•	•	•	Provide a redundant fuel supply route to the installation. For example, an installation may be able to supply fuel via truck or via rail. If one off-site supply route faces disruption, a redundant supply will ensure critical loads can be sustained until the primary supply is restored. This can include additional infrastructure, availability guarantees in contract, and alternate fuel contractor.

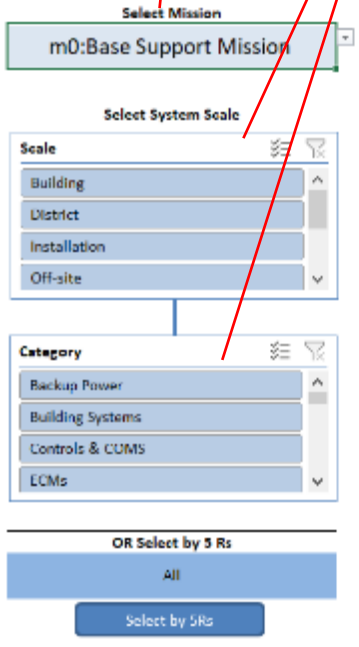
Application of Resiliency Strategies

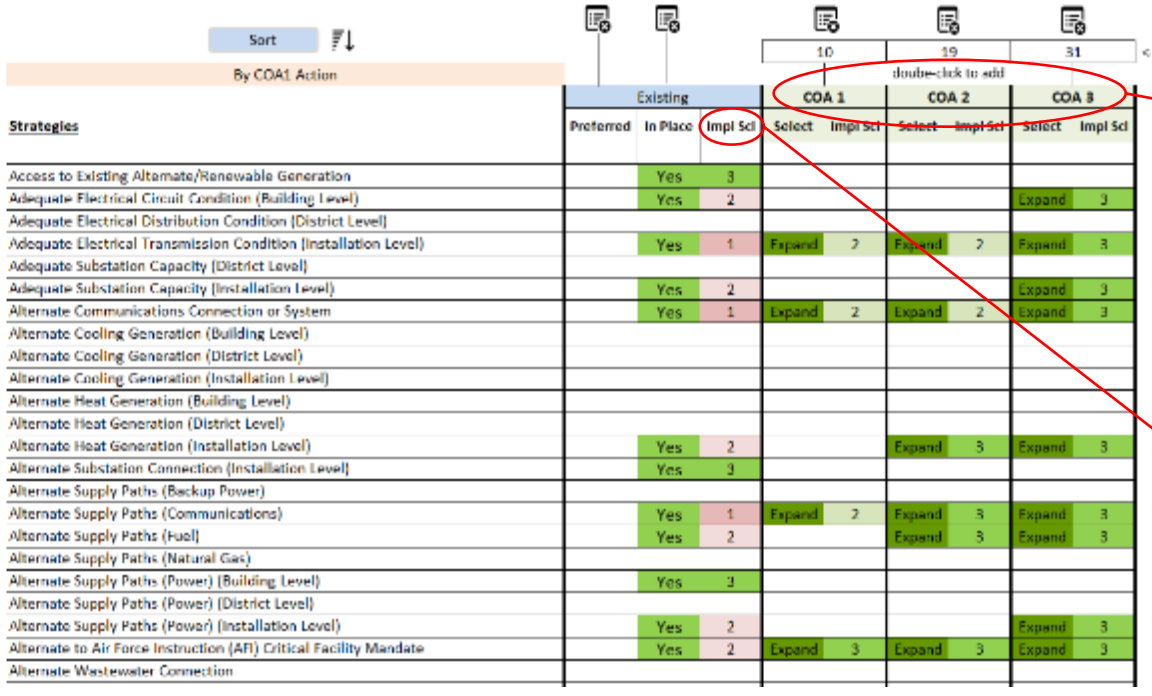
Step 1: Select mission area

Step 2: Determine applicability of 150+ resiliency strategies for the mission area based on scale and category

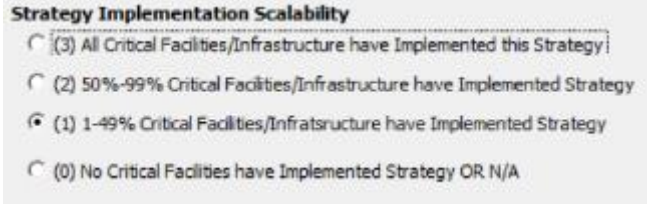
Step 3: Assess implementation scale for applicable strategies

Step 4: Evaluate Courses of Action (COAs) that would improve implementation scale

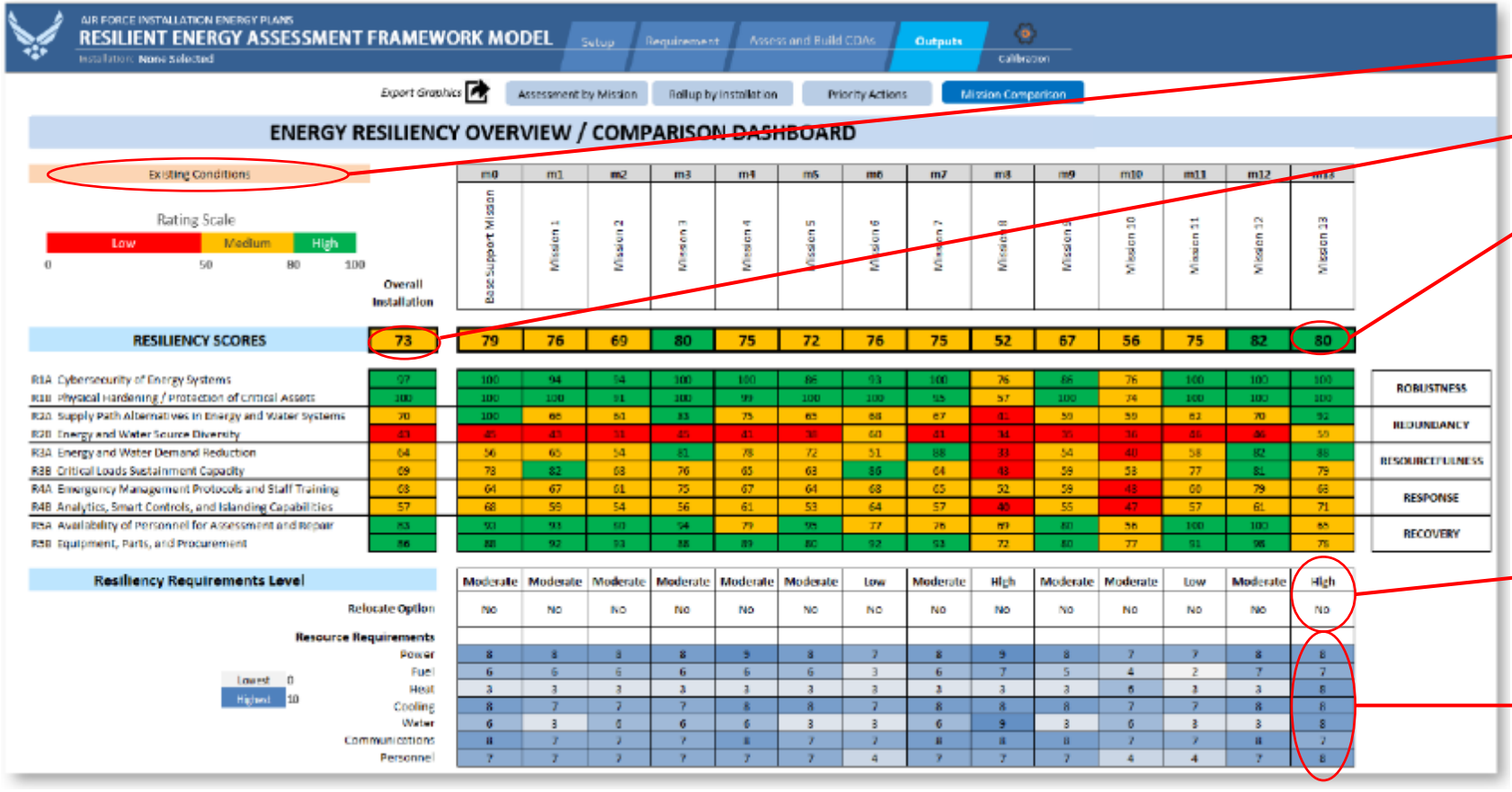




COA	DEFINITION
COA 1	Strategies that reflect projects that are already planned and funded to be implemented by the Installation or Mission Group.
COA 2	Strategies that have been deemed beneficial for the Installation or Mission Group to pursue beyond what is already in place or planned. COA 2 builds on the performance of COA 1.
COA 3	Strategies that would maximize the resilience posture of the Installation or Mission Group. While COA 3 is intended to be used as an alternative to COA 2, it is often used as a "best case" scenario for proposing more aspirational strategies beyond what is proposed in COA 2. COA 3 builds on the performance of COA 1.



Resiliency Assessment – Mission Comparison



Select Existing Conditions, COA1, COA2 or COA 3

Installation roll-up score and breakdown by 5R's

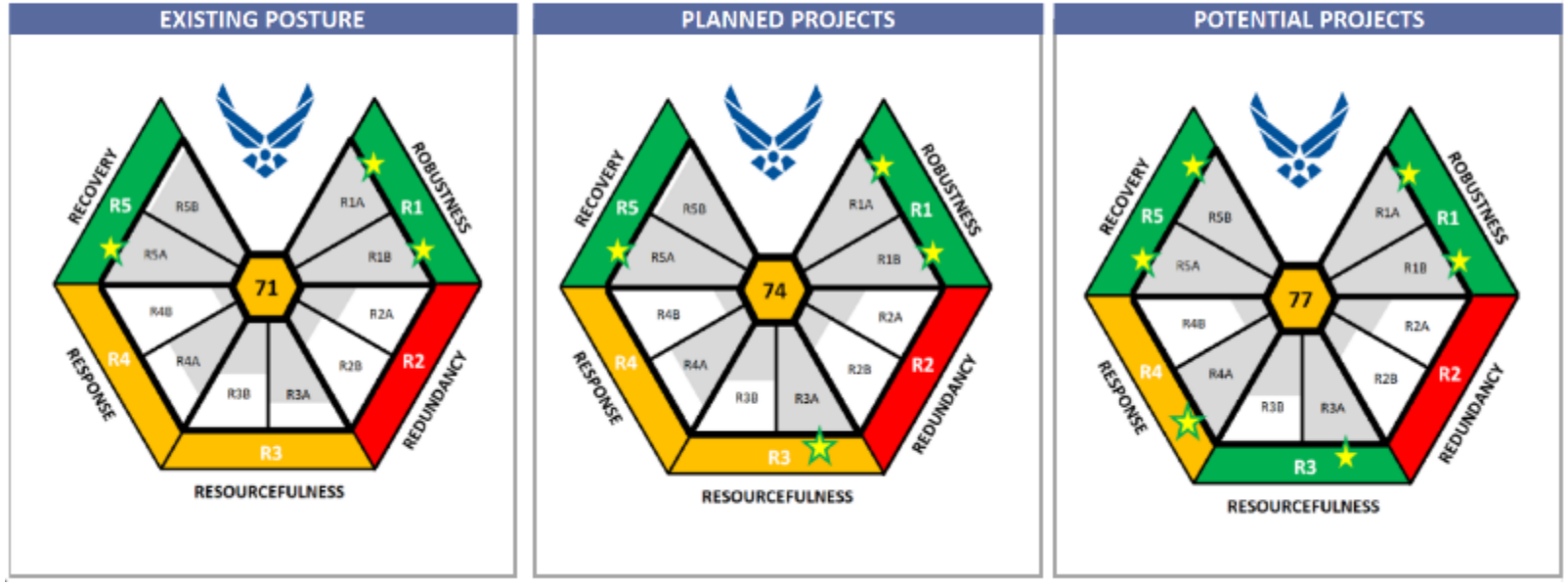
Mission roll-up score and breakdown by 5R's

Comparison of resiliency requirement levels and ability to relocate

Comparison of resource requirements by mission

Resiliency Assessment – Mission Scorecards

Mission Resilience Scorecards



COA 1 **COA 2** **COA 3**

R1 ROBUSTNESS
R1A Cybersecurity of Energy Systems
R1B Physical Hardening / Protection of Critical Assets

R2 REDUNDANCY
R2A Supply Path Alternatives in Energy and Water Systems
R2B Energy and Water Source Diversity

R3 RESOURCEFULNESS
R3A Energy and Water Demand Reduction
R3B Critical Loads Sustainment Capacity

R4 RESPONSE
R4A Emergency Management Protocols and Staff Training
R4B Analytics, Smart Controls, and Islanding Capabilities

R5 RECOVERY
R5A Availability of Personnel for Assessment and Repair
R5B Equipment, Parts, and Procurement

Campus Environments are the Backbone of the Infrastructure we Count on

They Support our Heath

They Educate our Children

They Provide Entertainment

They Provide Goods and Services

They Protect our Way of Life

Different Missions same Goals

Evaluation Process

- Clearly defined mission
- Defined set of evaluation criteria
  - ✓Quantifiable
  - ✓Repeatable
- Results highlight strengths and weaknesses
- Identify potential paths forward

Expansion of Criteria – Beyond the 5 R's

- *Resilience*
- Safety
- Sustainability
- Cost of Service
- Environmental, Social and Governance (ESG)
- Community Outreach and Support

SOCIAL & ENVIRONMENTAL	Climate Action	Energy system reduces greenhouse gas emissions by 30% per MWh compared to grid-supplied electricity.	1	3.0%
		Energy system reduces greenhouse gas emissions by 50% per MWh compared to grid-supplied electricity.	2	
		Energy system emits zero greenhouse gas emissions during operations.	3	
	Stakeholder Acceptance	UNMC leadership accepting and community concern / objection to alternative.	2	8.0%
		UNMC leadership accepting of alternative and/or community ambivilant to alternative.	6	
		UNMC leadership and community accepting of alternative.	8	
	Health	Energy system reduces air pollutants by 30% per MWh compared to grid-supplied electricity.	2	10.0%
		Energy system reduces air pollutants by 50% per MWh compared to grid-supplied electricity.	6	
		Energy system does not emit pollutants that impact regional air quality during operations.	10	
	Regulatory	Energy system subject to increasingly stringent regulatory and permitting requirements during construction and operational phase.	0	3.0%
		Energy system subject to stringent, but manageable, regulatory and permitting requirements during construction or operational phase.	2	
		Regulatory and permitting requirements present minimal obstacles during construction or operation of the energy system.	3	

Broad Application – Beyond AF and DoD

- Buildings in Mixed Use Developments or Urban Systems
- Manufacturing/Industrial facilities – Compare locations
- Education – Compare campus' within system and benchmark
- Hospitals under common ownership
- Big box stores and distribution facilities
- Transit agencies
- Data Centers

Summary

- DoD prioritized energy assurance
- The Air Force developed a repeatable process to evaluate installations
- This methodical approach can be used to evaluate and plan across a variety of:
  - Time horizons
  - Mission Criteria
  - Geographies

What Does Energy Assurance Mean to You?

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