

# Army Installation Energy and Water Plans: Redstone Arsenal Case Study

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*On behalf of HQDA*

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*"It is now undeniable that the homeland is no longer a sanctuary. ... attacks against our critical defense, government, and economic infrastructure must be anticipated"*

**National Defense Strategy 2018**

*"The Secretary of Defense shall ensure the readiness of the armed forces for their military missions by pursuing energy security and energy resilience"*

**10 USC 2911 (2018 NDAA)**

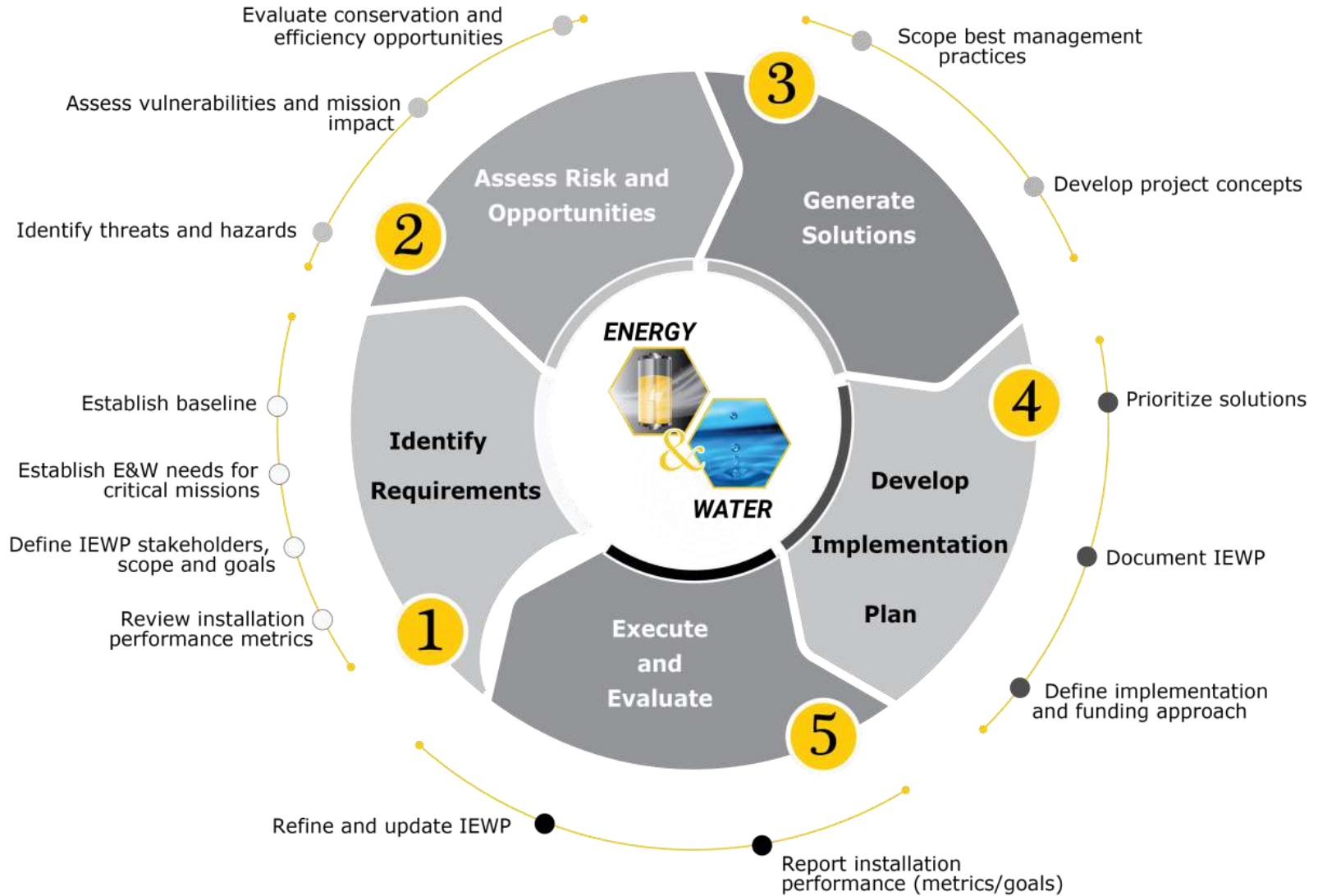


**"Never in my 36 years as a soldier has the Army looked at the strategic support area the way it does now. Installations are not second to an infantry brigade combat team at war. I would argue that if we don't get this right the IBCT might not make it to the fight."**

**- GEN Perna, Commanding General Army Materiel Command**

## Army Directive 2020-03 (Installation Energy and Water Resilience Policy)

- CRITICAL MISSION SUSTAINMENT (CMS): Critical mission continuity of operations for mission-driven duration (default 14 days)
- ASSURED ACCESS (AA): Dependable supply of energy and water needed to meet evolving mission requirements during normal and emergency response operations
- INFRASTRUCTURE CONDITION (IC): Infrastructure capable of on-site storage and flexible and redundant distribution networks to reliably meet mission requirements
- SYSTEM OPERATION (SO): Trained personnel conduct required energy and water security system planning, operations and sustainment activities





- Redstone is unique in several ways, but Army IEWP analysis process still applies
- Onsite and dedicated utility resources
  - PV + storage
  - Steam from offsite waste-to-energy plant with dedicated feeds
  - Mixture of city and onsite water supply
- Army + non-Army Federal agencies (~2k military personnel and family, ~40k civilians)
  - HQ for Army Materiel Command (AMC) and subordinate commands
  - Space and Missile Defense Command
  - NASA Marshall Space Flight Center
  - Federal Bureau of Investigation (FBI)
  - DoD's Missile Defense Agency
- Mission activities
  - Technology research, development, test, & evaluation (RDT&E)
  - Space and missile defense mission operations
  - Acquisition, materiel development, logistics, sustainment
- Plans for significant growth - several thousand new occupants and associated infrastructure over coming years

<b>Army HHQ Goals</b>		
<b>Critical Mission Sustainment</b>	<b>Critical Mission Risk Reduction</b>	<b>Installation Risk Reduction</b>
Ensure critical missions have the E&W needed to sustain operations under any operating conditions	Reduce risk of critical mission disruption from E&W system deficiencies	Reduce risk to all installation missions from E&W disruptions and improve performance where life-cycle cost-effective
<b>Redstone Goals</b>		
<ol style="list-style-type: none"> <li>1. Meet Army goals for energy and water use intensity reductions and for E&amp;W cost savings.</li> <li>2. Utilize meter data to drive and validate projects.</li> <li>3. Provide sufficient staff for building automation system and IT support.</li> <li>4. Increase resilience to alleviate identified risks and meet Army requirements, within limits of available Army funding.</li> </ol>		



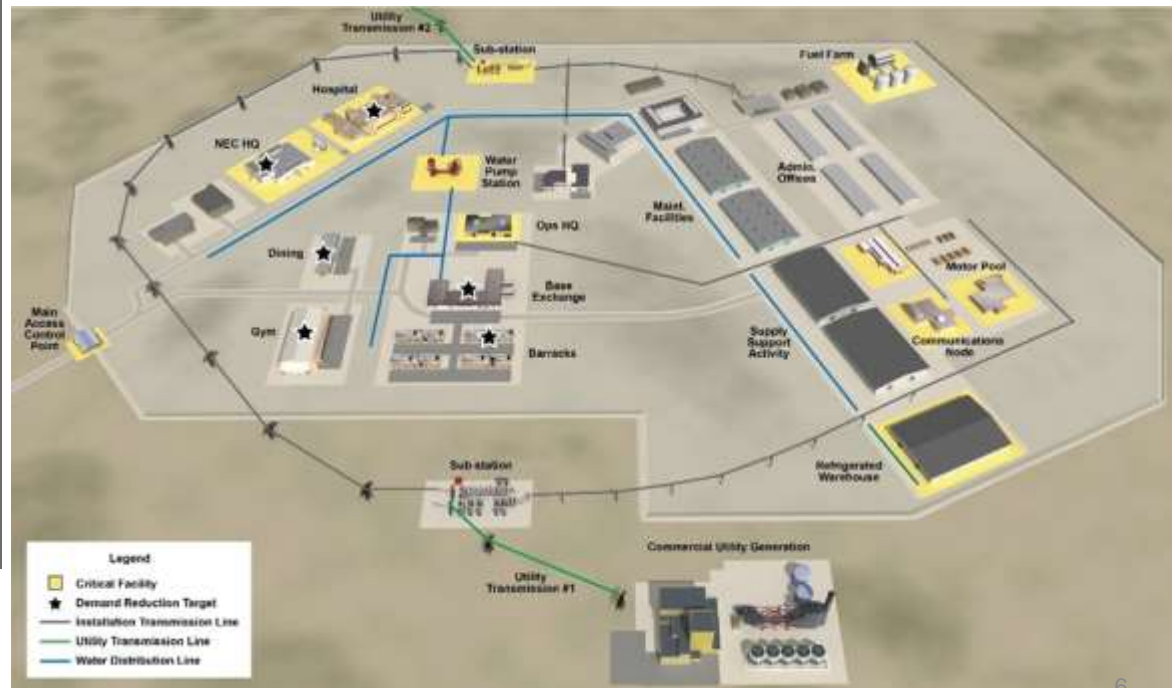
**Critical facilities:** buildings and utility infrastructure that because of their function, size, service area, or uniqueness, have the potential to cause disruption to mission critical functions or harm to humans

### Example Critical Facilities:

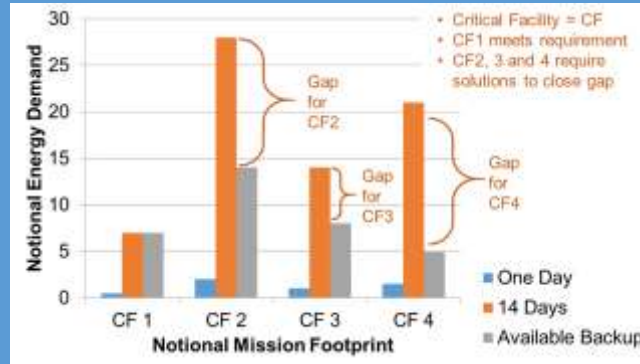
- Garrison Headquarters
- Emergency medical
- Emergency operations
- Airfield operations
- Data centers supporting mission activities
- NEC nodes
- E&W utility infrastructure
- Logistics & Supply
- Maintenance
- Production facilities
- Intelligence operations
- RDT&E facilities

Diverse set of tenants and mission activities on Redstone results in a prioritized approach to critical footprint

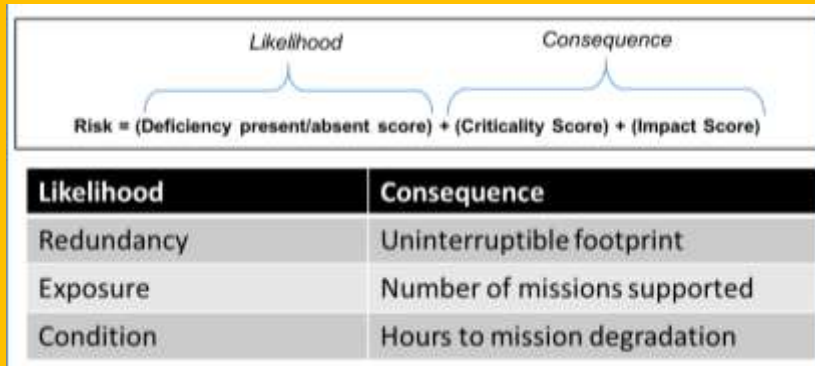
- Operational & Infrastructure
- DoD & Other Federal
- Army Missions
- Life/Health/Safety



## Critical Mission Sustainment (CMS)



## Critical Mission Risk Reduction (CMRR)



## Installation Risk Reduction (IRR)

Notional ISR-MC ratings:

Attribute	Measure	Rating
Critical Mission Sustainment	Documented, prioritized list of critical missions and their supporting facilities and infrastructure	RED
Infrastructure Condition	Overall condition of the installation's potable water treatment facility(ies)	RED
	Overall condition of the installation's water main(s) and distribution system(s)	GREEN
	Capacity of wastewater treatment system	AMBER

## 4 categories of COAs:

- Enhance Operations and Plans
- Reduce Demand
- Improve Infrastructure
- Increase Capacity

### Example COA Summary: Add Energy Storage to Existing PV Arrays

Priority Criteria	Summary
<b>Risk reduction</b>	<b>CMS:</b> Provides backup capacity for CMS
	<b>CMRR:</b> Provides backup power for critical facilities
	<b>IRR:</b> Reduces outages at facilities, increases onsite supply capacity, and provides ability to island
<b>Cost to implement</b>	Location dependent: \$4M–\$10M+ per array \$2,000/kW (\$500/kWh) for Li-ion storage; \$2M+ for microgrid infrastructure
<b>Operational efficiency</b>	Firm reduction of contract demand: under curtailment, energy storage can optimize dispatch and reduce grid requirements, TOU arbitrage
<b>E&amp;W demand reduction</b>	N/A unless more PV added
<b>Funding potential</b>	Modify existing ESPC contracts, ERCIP, UESC
<b>O&amp;M impact</b>	Ongoing O&M can be integrated with existing PV and/or substation maintenance activities
<b>Feasibility</b>	Technically feasible, interconnection and islanding add complexity. Possible challenges if contract mods are required.



- Prioritize projects to address highest risk issue first
- Workshop participants: DPW, DOD missions, installation tenants
- Workshop objectives
  - Review & validate critical mission footprint, IEWP purpose, and goals
  - Obtain feedback on and prioritize proposed courses of action (COAs)

IEWP Projects (Notional)	Risk Reduction Contribution								Priority		
	CMS	CMRR	IRR	Cost to Implement	E&W Demand & Cost Redn.	Ability to Fund/Execute	O&M Savings	Feasibility	①	②	③
<b>Distributed Generation/Storage</b>											
Area / Campus Microgrids	11 bldgs	11 bldgs	Yes	\$\$\$						②	
Add Storage to Existing PV	19 bldgs	19 bldgs	Yes	\$\$\$					①		
Steam Plant Cogeneration	6 bldgs	N/A	Yes	\$\$-\$\$\$							③
<b>Electric Distribution System</b>											
Electrical Power Distribution Switching	N/A	Yes	Yes	\$\$-\$\$\$					①		
<b>Generators</b>											
Centralized Backup Generators	15 bldgs	15 bldgs	Yes	\$\$					①		
Mobile Generators	10 bldgs	Yes	N/A	\$						②	
Backup Generators for Critical Facilities	25 bldgs	25 bldgs	N/A	\$\$-\$\$						②	
Generator Refueling	40 bldgs	40 bldgs	Yes	\$					①		
<b>Natural Gas</b>											
Gas System Capacity	N/A	N/A	Yes	\$\$-\$\$\$						②	
<b>Water and Wastewater</b>											
Water Curtailment Plan	80 bldgs	80 bldgs	Yes	\$					①		
Water Distribution Vulnerability Analysis	N/A	Yes	N/A	\$					①		
Pipeline Repairs/Replacements	N/A	Yes	Yes	\$						②	
Water Treatment Plants Rehab	N/A	Yes	Yes	\$\$					①		
WTP Backup Generation	Yes	Yes	N/A	\$\$							③

- IEWP is detailed path to improved resilience
- Various execution methods considered for each COA
  - Appropriated: MILCON, ERCIP, SRM, O&M budget
  - Third party: PPA, ESPC, UESC, utility partnership

Task No	Task Title	Responsible Party	Funding Type	Task Start		Task End	
				FY	Qtr	FY	Qtr
<b>1</b>	<b>OP – Operations and Plans</b>						
1.1	Emergency Planning (understand available resources, develop plans, practice plans)	DPW	O&M Budget	2020	2	2024	3
1.1.1	Develop UPS inventory	DPW-Electric	O&M Budget	2020	2	2024	2
1.1.2	Improve and enhance generator refueling practices	DPW-Electric	O&M Budget	2020	2	2021	2
<b>2</b>	<b>RD – Reduce Demand</b>						
2.1	Integrate critical facilities to central BAS and optimize HVAC Building Controls	DPW-Electric	UESC, ESPC, or SRM	2020	2	2022	1
2.1.1	Verify HVAC control type for buildings listed as candidates to integrate to central BAS	DPW-Electric	O&M Budget	2020	2	2020	3
2.1.2	Develop SOW to include re-tuning of critical facilities and connection of local-only BAS to BOCC. Consider incorporating non-critical facilities with high savings potential	DPW-Electric	O&M Budget	2021	3	2022	1
<b>3</b>	<b>INF – Improve Infrastructure</b>						
3.1	Replace manual transfer switches with automatic switches	DPW-Electric	SRM	2020	1	2024	3
3.1.1	Prioritize areas and buildings for upgrading switches	DPW-Electric	O&M Budget	2020	1	2021	3
3.1.2	Determine generation capabilities in each prioritized area to determine how much load can be met during emergencies	DPW-Electric	O&M Budget	2020	4	2021	3
3.1.3	Identify switches to be upgraded to meet loads with existing or planned generation	DPW-Electric	O&M Budget	2021	4	2022	1
<b>4</b>	<b>CAP - Increase Capacity</b>						
4.1	Add storage to existing PV	OEI	PPA	2020	1	2022	4
4.1.1	Consider other loads that could be served by PV and define the microgrid boundary	OEI	OEI	2020	1	2020	2
4.1.2	Obtain interval data for the loads to be included (minimum 1 year)	OEI	OEI	2020	1	2021	1
4.1.3	Revise existing contract to include additional storage and microgrid, and secure energy delivery to installation	Contracts	O&M Budget	2022	1	2022	4

- Installation uses IEWP as resource to pursue funding
  - **Detailed plan** and checklist facilitate project execution
  - Projects prioritized in IEWP **more likely to be awarded programmed funds**, using risk reduction identified in IEWP as justification
- Annual refresh and 5-year full update show progress and allow incorporation of changes on installation
  - Refine details on Redstone's planned expansion
- Subsequent IEWPs have incorporated lessons learned
  - Target select, priority COAs for more detailed development
  - Focus building audits on identification of resilience measures and critical equipment in place, with efficiency opportunities a second priority

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