Resiliency for an Entire Installation

A Case Study at Camp Pendleton, VA

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- **What is it?**
- **Do we need it?**
- **How do we do it?**
- **A case study**

Resiliency

It may have started as an energy program (w/focus on Power) …

But it transitioned into a mission readiness program focused on:

- Force Projection, Mobilizing, Deploying
- Strategic Command and Control
- Global ISR
- Life, Health, & Safety

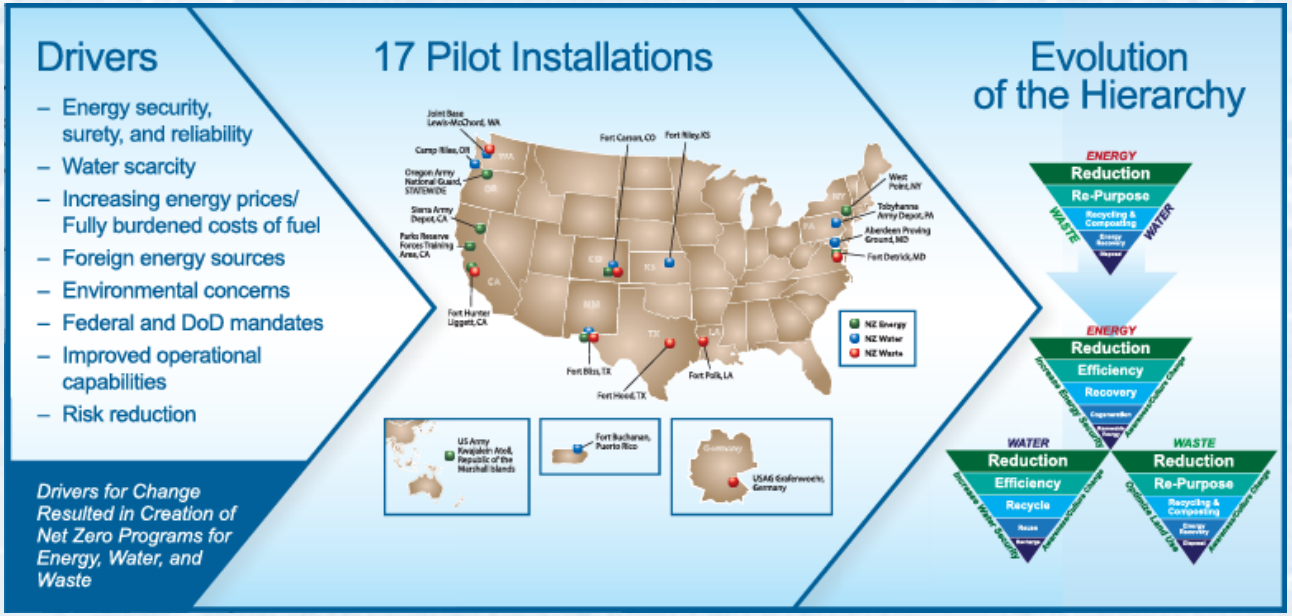
Resiliency

Webster defines resiliency as an ability to recover from or adjust easily to misfortune or change.

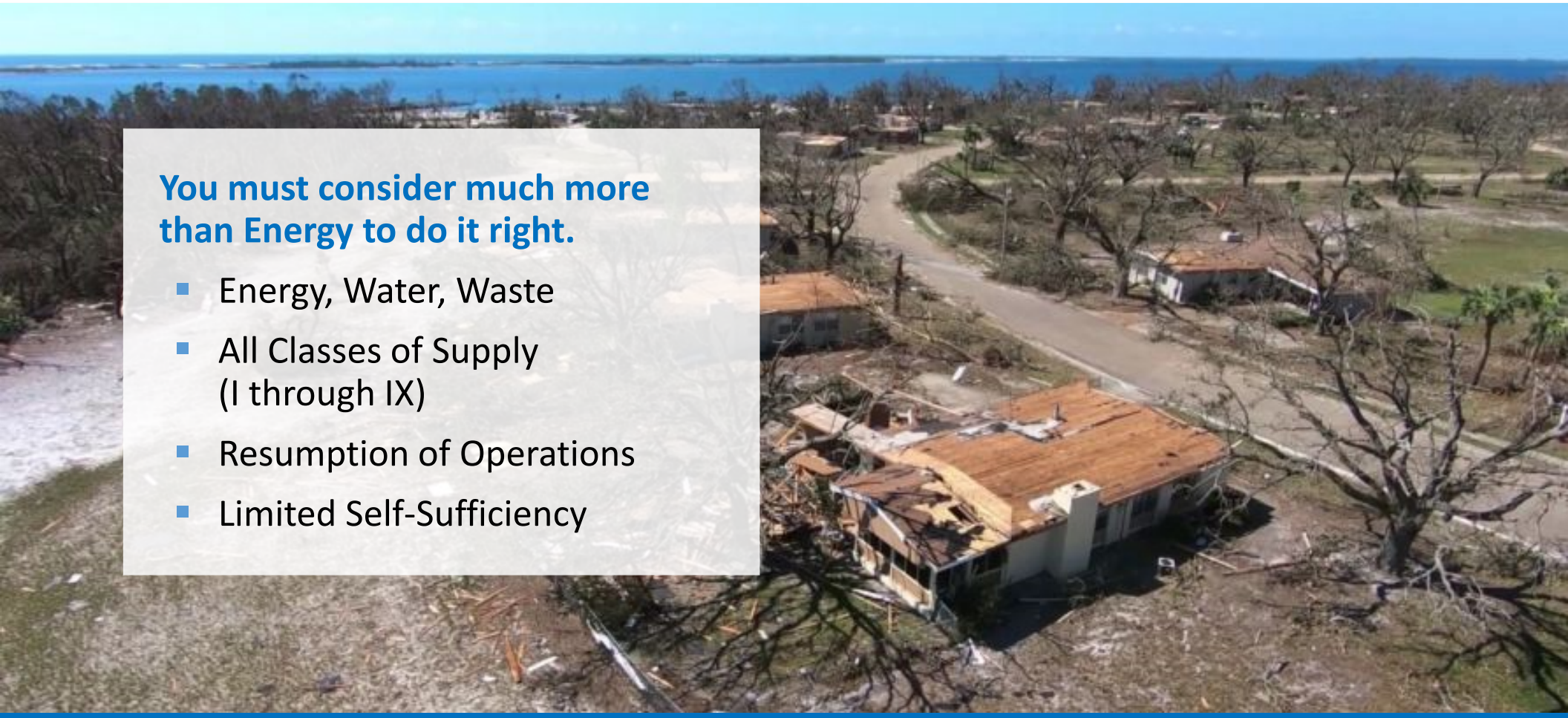
- Utility Monitoring and Control Systems (UMCS)
- HVAC Controls and Systems
- Commissioning and Retro-Commissioning
- Energy Savings Performance Contracts (ESPC)
- Environmental Security Technology Certification Program (ESTCP)
- Co-generation plants (multi-fuel, biomass, natural gas, etc)
- PV, Solar Walls, Microgrids, P3 & P4 (creative approaches to funding)
- Power Purchase Agreements (PPA)
- NET ZERO

An Energy Program?

- Energy, Water, Waste…less is more (and Zero is less)
- Pilot projects – Leak Detection, Water Reuse, Solar, Recycling, Composting, etc



Is **Net Zero** Resiliency?



You must consider much more than Energy to do it right.

- Energy, Water, Waste
- All Classes of Supply (I through IX)
- Resumption of Operations
- Limited Self-Sufficiency

Resiliency

Department of Defense (DoDI 4170.11) defines energy resilience as "the ability to prepare for and recover from energy disruptions that impact mission assurance on military installations."

Hurricane Michael – 10 October 2018

Tyndall AFB – 2018

10 Oct 18, 1230 CDT – CAT 5 Hurricane landfall
Maximum sustained winds of 155 mph
Storm surge: 9 – 14 ft at Mexico Beach


CAMP LEJEUNE
HOME OF
EXPEDITIONARY
FORCES IN READINESS

YANMAR

2D BATTALION 2D MARINES
EASY COMPANY

DoD: OASD(EI&E) leads an Energy Resilience Working Group (since December 2012) to better understand energy resilience requirements to enhance mission assurance on its installations.

Army: Jack Surash, Acting DASA (E&S) states "energy efficiency and conservation projects have taken a back seat to investments aimed at enhancing energy resilience…the service's top priority is resilience."

Air Force: The Office of Energy Assurance (February 2016) serves as the single point of entry for all strategic energy and resiliency initiatives with these goals: improve resiliency, optimize demand, assure supply.

Resiliency

Camp Pendleton, VA

- Our Team
- The Installation
- The Process & Findings

Case Study

Case Study

OUR TEAM (Better together & focused on customer)

- **Jacobs:** Contract holder & Program manager
- **OTIE:** Primary subcontractor & Project manager
- **Power Secure:** Utility coordination & generation
  - Unique access & understanding of power/providers
  - Relationship with the customer
- **ZAPATA:** Relationships w/OTIE, Power Secure, AME
- **AME:** Specialty sub focused on Electric and Comm

THE INSTALLATION: Camp Pendleton

VAARNG Installation

- Camp Pendleton State Military Reservation
- 325 acres & need 24/7 resilient capability
- FEMA operating base for Cat 3 hurricane; response training/staging for disasters
- Self sufficient for 2,000 people (60 days)
  - Electric Power & Communication
  - Potable Water Distribution
  - Fuel (Natural Gas/Diesel)
  - Communications
  - Sanitary Sewer collection/treatment
- #1 Project on the VA TAG list

Case Study

OUR PROCESS

- Meet with Installation to Learn Mission/Priorities
- Assess Current Condition/Capabilities
- Perform Analysis
- Develop Master Plan
- Recommendations

Case Study

SCOPE

- **Energy Alignment Plan:** Address current energy economics and describe strategic recommendations for power system improvements accompanied by project financial projections to justify the cost
  - Developed reference costs for energy that could be generated onsite & compared to the “avoided cost” of Dominion Rates to determine value of onsite generation
- **Dynamic Power Model:** Examine existing configuration and power flows when the electrical, potable water, sewer, and prime generation components of the proposed surety plan are implemented
  - Assess the Voltage Drop and Load Flow, for the distribution system; and the Fault Current for each feeder

Power

The Assessment:

- Serviced by Dominion Energy
- Current rate schedule is Dominion 6VA rate (Large General Service)
  - 1992 Grandfathered rate schedule (similar to current schedule GS-4)
  - Two year average rate is $0.0792/KWh
- Opportunities w/in the PJM Interconnection & onsite generation
  - Diesel
  - Bi-Fuel
  - Natural Gas
  - Photovoltaic

Power

The Analysis:

- Diesel = $0.1717/KWh
- Natural Gas = $0.0857/KWh
- Proposed Bi-fuel Generator (60% NG, 40$ Diesel) = $0.1065 KWh
- Option 1 – Avoided Cost Assessment of onsite generation
- Option 2 – Demand Response Assessment
- Option 3 – PV Assessment
- Perform a 20-year pro-forma evaluation

Power

The Plan:

- Install generation w/parallel switchgear but defer interconnection until it becomes commercially feasible to inject generation onto the Dominion system
- Utilize 1.2 MW natural gas generator to “island” from the grid at all times – reduces Dominion Rate 6VA costs and increases costs for onsite generation
  - PV not economically feasible
- Requires VAARNG to reserve standby capacity on Dominion’s grid by purchasing under Dominion Virginia’s Rate Schedule 8 (“Supplementary, Maintenance, Standby Service for Customers with Power Plants”)
- Purchase a 1 MW portable standby diesel generator for supplemental power when Camp Pendleton is at full emergency housing capacity and electrical load

Power

The Assessment:

- Multiple (five) feeds to the base creates problems/inefficiencies
- Poor redundancy, poor configuration and limited back-up
- Overhead power lines at risk during hurricane
- No dedicated circuits means more/un-necessary outages

Electrical Distribution

The Plan:

- Consolidate all of the electrical services on Camp Pendleton to one point
- Reconfigure the primary power distribution into a loop feed for redundancy
- Move overhead power lines underground
- Provide distribution (15kV switches, duct-banks, manholes) required to relocate medium voltage underground
- Replace pole mounted transformers w/ground mounted (on elevated platforms)
- Tie the new generator plant into the distribution
- Provide required infrastructure to support the new prime generator(s)

Electrical Distribution

The Assessment:

- Current communications distribution system enters base from both North (underground) and South (overhead)
  - Overhead lines at risk during hurricane
- Main communications building does not feed entire base & is not connected to the North side of base
  - Poor redundancy & configuration
- System is not fiber, at risk from EMP

Communications

The Plan:

- Relocate all existing overhead communications to underground
- Replace all communications distribution with fiber (protect against EMP)
- Address redundancy by keeping the two points of service (North and South) into the base but extend/connect the North access to the Main Communications Building to establish two paths
- Install a new communications duct bank throughout the base (where currently overhead) and tie into the existing underground distribution

Communications

The Assessment:

- Existing distribution lines may be used to supply water to dining facilities, laundry and sanitary facilities
- Consider pressurizing the existing domestic and fire protection system
- Need potable water for drinking and food preparation
- Lake Christine is a source of water if municipal supply fails
- Processed water will be stored & the distribution system will be pressurized

Potable Water

Planning Factors:

- Produce water to support 2,000 people for 60 days (temperate/conventional)
- Requirements include drinking, personal hygiene, field feeding, heat treatment, and Role I and II medical operations will not be compromised
- Requirements exclude mortuary affairs, engineer construction, aircraft maintenance, watercraft maintenance , Refugee operations, etc
- Water sources are accessible and exploitable
- Water distribution equipment is available (VAARNG or commercial)
- A 10% loss factor, comprising 4% evaporation and 6% waste/spillage

Potable Water

Planning Factors (continued):

- Seven showers and 15 pounds of laundry (per person, per week)
- Water requirements for food preparation are based on a ration cycle of two hot meals and one Meal Ready to Eat (MRE) per day (disposable dinnerware)
- Any new toilets installed will meet the most current federal standard of 1.6 gallons per flush (gpf)

Potable Water

The Plan:

- **Water Demand:** 22.33 gallons/person/day or 44,660 gallons per day
- **Emergency Water Source:** Lake Christine (determined it has capacity)
  - Contains 24M gallons of water, is accessible and exploitable
- **Water Treatment:** 4 Tactical Water Purification Systems (ROWPU)
- **Water Storage:** Install four 40,000 gallon above-ground steel water tanks
- **Water Distribution:** Use existing lines and augment with 5400 LF of new 6” PVC
  - Carry (underground) water from the Lake to the supply building
  - Preventive medicine to inspect; Conservation considerations – bottled water & grey water

Potable Water

The Assessment:

- Minimal diesel storage capacity on the installation – only enough for vehicle fueling
- Nearby natural gas available

Fuels

The Plan:

- It is assumed the generators will be multi-fuel
- Currently, only a small diesel storage area on installation
- Not efficient to store diesel fuel for 6 months, designed for 60 day
  - 60 days requirement is 88,000 gallons (5 x 20,000 gallon tanks)
  - VAARNG can resupply by ground or air if needed
- Commercial source of natural gas (300 psi) just off the installation along General Booth Road

Fuels

The Assessment:

- The wastewater collection system was installed during WWII
- Inflow and infiltration (I&I) study performed in 1972 (30,000 gpd)
- Design capacity is 50K gal/day (sanitary flow) + 30K gal/day (I&I) = 80K gal/day
- The main pump station was last renovated in 1981 (chlorination system)
- At ~35 years, these components are in the middle of their expected life span
- The capacity of the existing system is sufficient
- Rely on Hampton Roads Sanitary District (HRSD)

Sanitary Sewer

The Plan:

- Primary sources of sanitary wastewater are toilets, showers, and laundry
- Location of discharge must be coordinated for collection and will include leach fields, pump stations, and packaged sanitary treatment
- Options assessed: oil/water separation, primary clarification, secondary treatment, tertiary treatment, disinfection, sludge processing/disposal
- Replace the two 25 horsepower rail mounted submersible sewage pumps to the Hampton Roads Sanitary District (HRSD)
- Need larger with variable speeds controlled by the wet well level
- Use HRSD sewer system and Atlantic WWTP as long as operational
- Provided a design option to install a packaged wastewater treatment plant

Sanitary Sewer

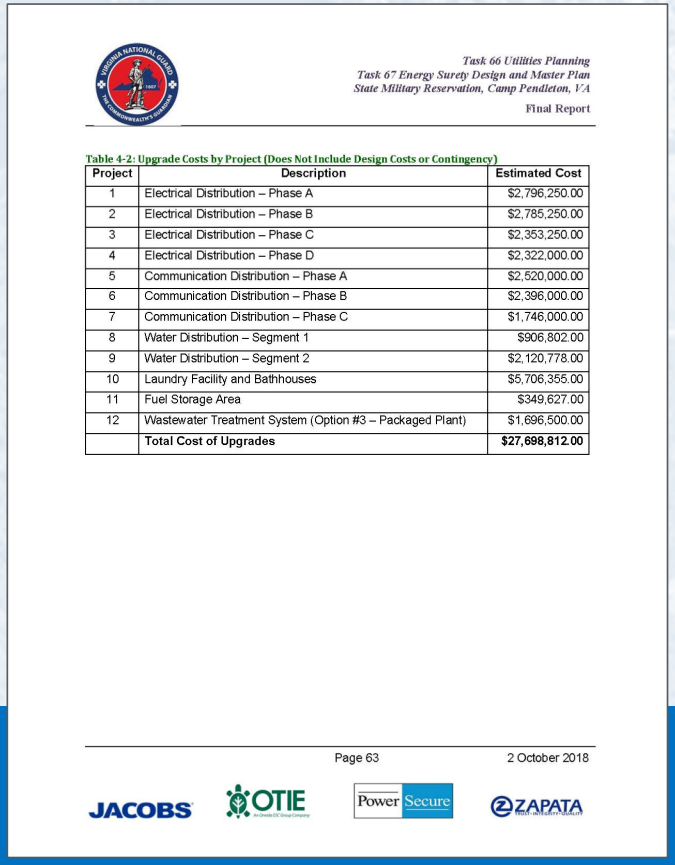
Camp Pendleton, VA

- Prepare scopes and ROM Cost estimates to define executable projects
  - ERCIP eligible Projects
  - Secure funding to implement
- Expand study to additional VAARNG Installations

So Now What?

Energy Resilience & Conservation Investment Program (ERCIP)

- Defense-wide MILCON program focused on Energy
- Army POC for the Program
  - US Army Engineering & Support Center, Huntsville
  - Gives Army stakeholders a direct path for Resilience $
  - Workshop w/stakeholders to improve process… more & integrate involvement (Districts), better projects
- Air Force POC for the Program
  - Air Force Civil Engineer Center, Tyndall
  - Projects as large as $15M…but prefer smaller
  - Usually $40M/year (8-12 projects)
  - AFCEC validates and ranks all projects based on energy and mission resilience



Task 66 Utilities Planning
Task 67 Energy Surety Design and Master Plan
State Military Reservation, Camp Pendleton, VA
Final Report

Table 4-2: Upgrade Costs by Project (Does Not Include Design Costs or Contingency)

Project	Description	Estimated Cost
1	Electrical Distribution – Phase A	$2,796,250.00
2	Electrical Distribution – Phase B	$2,785,250.00
3	Electrical Distribution – Phase C	$2,353,250.00
4	Electrical Distribution – Phase D	$2,322,000.00
5	Communication Distribution – Phase A	$2,520,000.00
6	Communication Distribution – Phase B	$2,396,000.00
7	Communication Distribution – Phase C	$1,746,000.00
8	Water Distribution – Segment 1	$906,802.00
9	Water Distribution – Segment 2	$2,120,778.00
10	Laundry Facility and Bathhouses	$5,706,355.00
11	Fuel Storage Area	$349,627.00
12	Wastewater Treatment System (Option #3 – Packaged Plant)	$1,696,500.00
	Total Cost of Upgrades	**$27,698,812.00**

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JACOBS OTIE PowerSecure ZAPATA

ERCIP

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Questions?