Marine Corps Recruit Depot, Parris Island Smart Grid

Energy Resilience / Security Using ESPC Contracts

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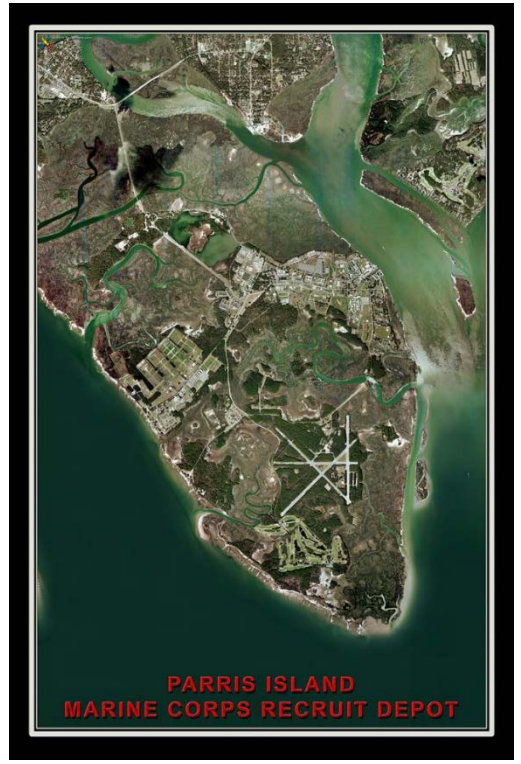
Public Works Officer

Marine Corps Recruit Depot, Parris Island

Mission: “WE MAKE MARINES”

- First permanent settlement in 1562 by the French
- Designated a Recruit Depot: 1 Nov, 1915
- 8,095 acres: 3,262 acres are habitable
- Approximately 700 buildings
- 242 facilities 20 years or older
- Second Oldest Marine Corps Base
- Invaluable natural & historic resources



Pre-Implementation

- Existing Energy Program Very Successful
  - Energy Use 37.9% below FY2003 baseline
  - Water Use 31.2% below FY2007 baseline
  - Extensive energy conservation measures
    - Geothermal Heat Pumps, Magnetic/Frictionless Chillers, Ice Storage, Net zero Facilities, PV and Solar Thermal Systems
- Depot-wide Building Automation Systems
- Advanced HVAC controls (over 100 buildings)
- Advanced Metering (over 100 buildings)
- Utility grid SCADA switching

Pre-Implementation

- **Existing Co-gen Steam Plant**
  - Built 1942
  - Three Boilers (50,000 lbs/hr / 400psig / 600F)
  - One Boiler (50,000 lbs/hr, 125psig saturated)
  - Natural gas with #6 oil as backup
  - Three 1 MW steam turbines (not operational)
  - Substantial yearly O&M investment
  - Well past normal life (75 years old)

The Project Plan

- **Leverage Energy Savings Performance Contracting (ESPC)**
  - Only One (1) Hard Requirement – Replace the Steam Plant
  - Allow for “Bundling” of energy technologies
  - Add renewables and energy security / resiliency
  - Open door, unfettered audit process
  - Don’t guide or direct the technical solutions
- **Began ESPC process in February of 2015**
- **Awarded 16 Dec 2016**
  - Only 22 months to award
  - Largest ESPC Awarded in Marine Corps, 2nd Largest in Navy
- **Ribbon Cutting – 20 June 2019**

Scenarios Evaluated

Option #	Description	Primary Fuel	Backup Fuel	Pros	Cons
1	Decentralization	Natural Gas	Propane Air	• Less labor-intensive maintenance without distribution system • Individual building controls	• High cost for low savings • More pieces of equipment to maintain • No redundancy
2	New Natural Gas Boilers	Natural Gas	Fuel Oil	• Low install cost • Uses existing infrastructure	• Lower energy savings • Significant unknowns with re-using Building 160 • Complexities during construction
3	New Boilers with Biodiesel Backup	Natural Gas	Biodiesel	• Backup fuel is from a renewable source	• Biodiesel fuel is more expensive • Not practicable for long-term storage
4	Biomass – Thermal Only	Biomass	Natural Gas	• Utilizes renewable energy • Lower capital cost vs. Option 5	• Design and construction complexities • More costly O&M/R&R (life cycle) • Training required for unfamiliar equipment
5	Biomass – Backpressure Turbine	Biomass	Natural Gas	• On-site generation from renewable energy • Decreased natural gas consumption	• Longer SPB than Option 4 • Longest construction term • Increased complexity from Option 4
6	Combined Heat and Power Plant	Natural Gas	Fuel Oil	• Best payback • Highest capacity and reliability for electrical generation • More redundancy	• Non-renewable fuel source • Increased electrical interconnect complexity

Summary of Modeled Results

Option #	Description	SPB[1]	Construction Duration Estimate	Estimated Cost	Cogeneration Capacity
1	Decentralization of Existing Steam Plant	32 Years	18 Months	$41 M	0 MW
2	Natural Gas Boilers Replacement	36 Years	18-24 Months	$18 M	0 MW
3	NG Boilers Replacement with Biodiesel Backup	43 Years	18-24 Months	$19.2 M	0 MW
4	Biomass Fueled Energy Plant – Thermal Only	26 Years	20-22 Months	$25 M	0 MW
5	Biomass Fueled Energy Plant– Backpressure Turbine	27 Years	22-24 Months	$40 M	2.75 MW
6	Combined Heat and Power Plant	16 Years	19-21 Months	$27 M	3.5 MW

Notes:
[1]Simple Payback is reflective of capital cost and energy savings. O&M costs have not been included in the simple payback calculation.

Solution Outcomes

Energy Savings Performance Contract

8 energy conservation measures

- Boiler plant; EMCS; renewable energy systems; lighting; chiller; HVAC; water; and hot water and steam distribution systems

$91 million

Project Investment

$7 million

Annual Savings

- Over 3.3 million square feet
- Ensures a reliable, secure energy supply
- Achieves sustainability requirements
- Reduces lifecycle operating costs of facilities

- 40,271 metric tons annual carbon reduction
- Over 29,000 LEDs installed
- New central plant with microgrid and island mode capability

35%

Energy Use Reduction

25%

Water Use Reduction

- Nearly $1 million in annual savings
- Over 10,209 plumbing fixtures changed or retrofited
- Reduction of heat loss and evaporation at mission-critical outdoor training pool

- 3.5 MW CHP Plant
- 3.6 MW Diesel Gensets
- 1.5 MW Solar PV carport
- 4 MW ground mount Solar PV
- 4 MW / 8 MWh Battery Energy Storage System (BESS)
- Microgrid Control System with Fast Load Shed

12.6 MW

Onsite Energy Generation

Central Heat and Power Facility

- Centaur 40 Gas Turbine (3.5 MW)
- HRSG Boiler (60,000 pph)
  - 4ea Additional Nat Gas Burners
- 2ea – 30 kpph Fire Tube Dual Fuel Boilers
- 3ea – Backup Diesel Generators
  - 2.7 MW Diesel Generator
    - Demand Management & Tertiary generation
  - 2ea - 455 kW diesel
    - Black Start & Backup
- 2ea – 50,000 gal Diesel Fuel Tanks

Renewable Energy - Page Field

- Page Field PV 4.1 Mw Solar Array
- Four (4) 750 kVA inverters
- Two (2) 500 kVA inverters
- One (1) 1000 kVA transformer
- One (1) 1500 kVA transformer
- 15,086 – 335-Watt Panels
- ~19 acres
- 3.5 - 3.8 acres per MW
- Produces power at a capitalized cost of $0.089 per kWh

Renewable Energy – Main Parade Parking

- Carport PV 1.65 MW Solar Array
  - Two (2) 750 kVA inverters
  - One (1) 1500 kVA transformer
  - 4, 883 ea – 355-Watt solar panels
  - Covered parking structures
  - Daylight & Motion LED lighting
  - Repave and restripe parking area
  - Hurricane and earthquake resistant
  - RV & Bus Structure Height

Battery Energy Storage – BESS

- Tesla Battery Energy Storage System (BESS)
- 4 MW / 8.1 MWh Lithium Ion Battery
- 10 Inverters
- 864 individual lithium ion battery pods equal to 2,200,000 standard AA batteries
- Absorbs over 1M kWh electricity annually for later use

Success

- Building on an already successful program to move ahead aggressively
- Energy Security & Energy Resilience
- Innovative & Comprehensive Solutions
- Open ESPC audit scope maximized investment opportunities & ESCO ingenuity
- Continued Utility grid development
- **“Bringing Out The Best”**

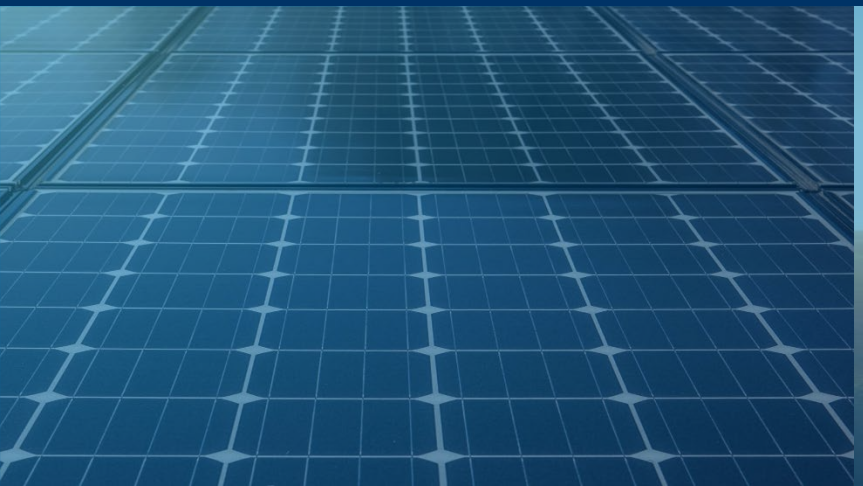
Questions?

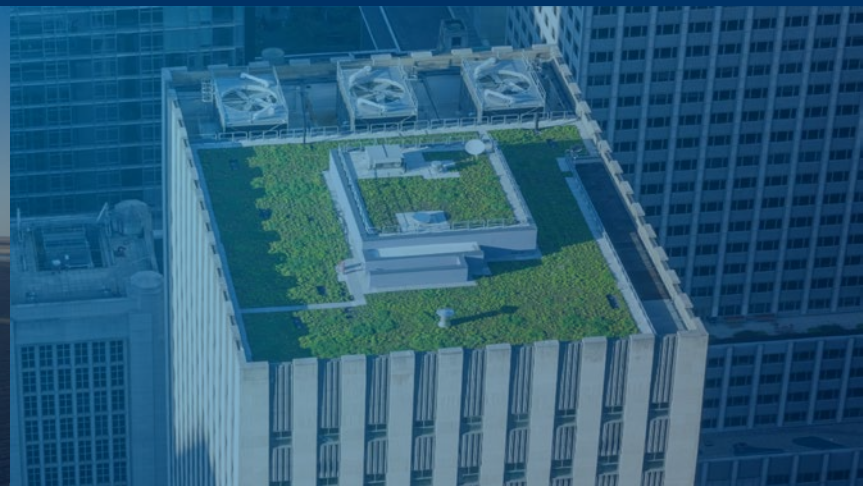
HANNON ARMSTRONG

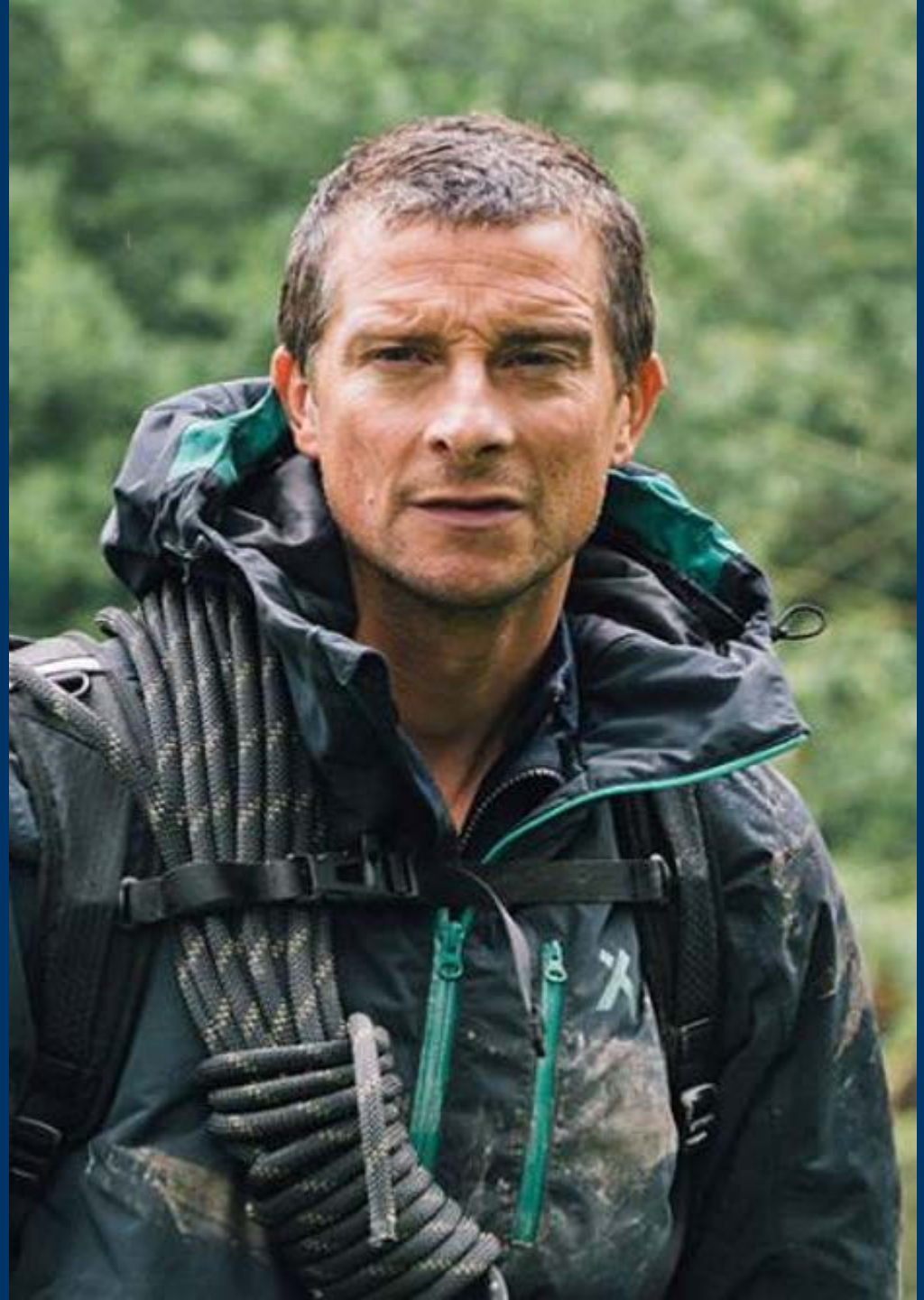
Financing Resiliency For MCRD Parris Island

February 11, 2020

INVESTING IN CLIMATE CHANGE SOLUTIONS







Remember the Rule of 3s:

- 3 Minutes without Air
- 3 Days without Water
- 3 Weeks without Food

- Bear Grylls

HANNON ARMSTRONG

Hannon Armstrong Profile

HASI
LISTED
NYSE

First U.S. public company solely dedicated to investments in climate change solutions

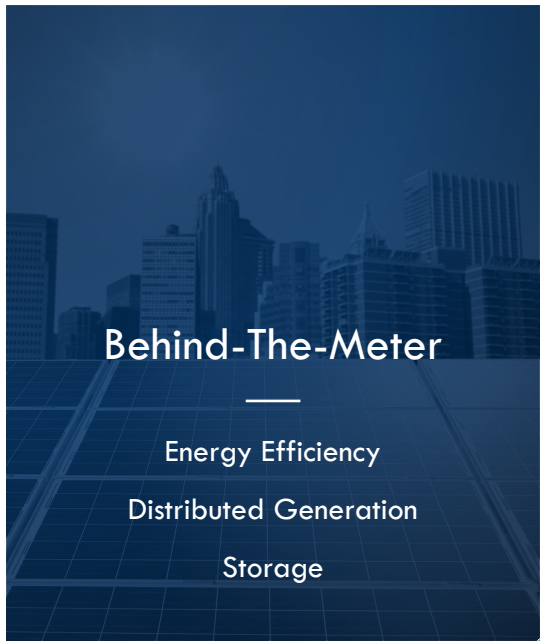
Principal Investor

~$1 Billion
Invested Annually

~$2 Billion
Balance Sheet Assets

$5.7 Billion
Managed Assets

Markets & Asset Classes



Project Paid From Savings

- Fence-to-Fence (Whole Base) Application
  - 121 buildings (3.1 million GSF)
  - 20 energy conservation measures
- Excess savings offset fixed costs of non-savings measures
  - Energy management control system
  - Over 29,000 LEDs installed
  - Reduced water consumption by 27% through increased efficient usage
- Total Project Cost: $91.1 million
  - Hannon Armstrong financed $85 million.
  - Ameresco will operate the facility for 22 years.

Financing Considerations

Technology

- CHP and solar known technologies
- Battery Energy Storage System (BESS) new technology
- Contractor's previous experience with BESS technology

Contractual

- ESPC Contract Authority 42 USC 8287
- Contractor guaranty's
- Financier Rights
- Termination provisions

Credit

- US Government is Obligor
- Ameresco as ESPC Engineer/Construction Contractor

Performance

- Savings Guarantees
- Operations & Maintenance plan
- System availability requirements

Thank you

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