Miramar has been a Navy or Marine Corps Air Station since 1940

Aircraft
- On average 200 aircraft are assigned to Miramar – Roughly 100 Fixed Wing, and 100 Rotor Wing and Tilt Rotor
- 65 to 95 thousand flight operations per year

People
- About 9,300 Marines and Sailors are assigned to Miramar
- 1,800 or 20% Marines and Sailors are deployed at any given time
- Approximately 1,700 civilians work on Miramar
- Approximately 17,000 dependents of Miramar service members attend schools in San Diego

On Base Housing
- 524 homes
- 3,832 bachelor quarters

Approximately 23,000 acres
• **Mission**
  – Sustain warfighting readiness and lethality by providing all energy-related policy and governance for programs and activities that enable resilient, efficient, and cyber-secure energy for Joint forces, weapon systems, and installations

• **ASD(Sustainment) priorities aligned to NDS**
  – Prepare the battlefield for 2025
  – Create and sustain resilient installations

• **Four primary focus areas:**
  – Energy Resilience
  – Energy Risk
  – Energy Performance
  – Cyber Secure Facilities
Aligning Policies with Strategy

**Installation Energy Plans (IEPs) Policy**
- DoD policy memo requiring IEPs (Mar ’16)
- Supplemental IEP Guidance (May ’18)
  - Expand IEPs to all installations; Priority installations’ IEPs to be completed by end of FY’19
  - Explicitly requires energy resilience (ER) and cybersecurity (CS) be part of each IEP
- Annual program reviews – maintain IEPs as living documents designed to identify, evaluate, & mitigate energy risks to critical missions

**Energy Resilience (ER)**
- DoD Power Resilience Review (Dec ’13 – Aug ‘14)
- DoDI 4170.11 Installation Energy Management: ER requirements added (Mar ‘16)
- MIT/LL ER Business Case Analysis Study (Oct ‘16)
- DoD ER Operations, Maintenance and Testing Guidance (Mar ‘17)
- Draft policy - DoD ER Guidance (ECD: FY ’19)

**Facility Related Control Systems (FRCS)**
- DepSecDef directs Components to cyber secure ALL control system types (Jul ‘18)
- DoD CIO directs Component alignment to DoD Cyber Strategy & Posture Review (Dec ’18)
Installation Level Microgrid
- Energy Security Microgrid for Critical Facilities
- FY2014 ECIP Project
- Awarded in May 2016 for $20M
- Projected Completion 2019
- Integration of Landfill Gas and PV renewables to a central natural gas and diesel power plant
- California Energy Commission Grant ($5M)
  - Energy Storage
  - Large Scale HVAC Demand Response

Building Level Microgrid
- Zinc Bromide Flow Battery Installation for Islanding and Backup Power
- FY2012 ESTCP Project ($3M) Demonstrated 2016
- 100% Renewable Island with only PV and battery storage
- HVAC, Lighting, and Plug load integration into microgrid control system
- Vehicle to Grid and multiple battery demonstration (California Energy Commission Project)
Installation Microgrid Map

Microgrid Backup Power Plant
- 4 MW Tier 4 Diesel Generator Set
- 3 MW BACT Natural Gas Generator Set
- Central Microgrid Controller
  - 3 MW / 1.7MWH Li-ion Battery (CEC Grant)

- 435 kW PV Carports

- 3.2 MW Landfill Gas Energy Plant
  - Addition 1.6 MW LFG Power

- 511 kW PV Carports

- 356 kW Thin-Film PV Roof Systems

- AWEMS HVAC Controller (80 Buildings)
  - DEMAND REPONSE (CEC Grant)

- 2 MW Backup Generator w/ATS Paralleling Switch Gear

- Future
Slide 6

**EPIC Grant**

**Addition of 3 MW Battery Energy Storage System**
- Displacing diesel generators as the primary source of backup power for the LFG
- Reducing demand charges when SDG&E is utilized as backup power for the LFG
- Allowing for increased renewable penetration in microgrid
- Improving power reliability and quality to allow 3.2 MW of LFG to be integrated into the DoD-funded microgrid when operating in islanded mode

**Enhanced Demand Response from Basewide HVAC Controls**
- Up to 1.6 MW of controllable building load
- Priority customization of over 80 connected bldgs.
- 3 available load shed levels
  - Thermostat adjustment
  - Compressor shut down
  - Complete Shutdown
DER and Load Summary

**Generation**
- 3.2 MW Landfill Power
- 1.5 MW PV
- 3.7 MW Diesel in Power Plant
- 2.8 MW Natural Gas in Power Plant
- 1.6 MW Additional Landfill Power
- 2 MW Telecom Back up Generator

**Total = 11.2 MW Current**
**14.8 MW Future**

**Base Loads**
- Total base peak = 14 MW
- Average load = 7 MW
- Critical Load = 3-6 MW (Over 100 buildings)

**Load Management**
- Thermal Energy Storage Plant (200 kW)
- Area Wide Energy Management System (DDC)
  - Automated Demand Response estimated 1.6 MW over 80 buildings
- Electric Vehicle Charging Stations (0 – 168 kW)

**Battery Storage**
- 3 MW / 1.5 MWH Li-Ion
- 250 kW / 600 kWh Li-Ion
- 25 kW / 125 kWh ZnBr Flow

Legend:
- Black = P-906 Installation Microgrid (ERCIP Project)
- Green = existing prior to installation microgrid
- Blue = future projects
- Orange = building microgrid (not controlled by installation microgrid)
Installation Microgrid Photos
Microgrid Modes of Operation

**Manual Mode**
- Grid Connected, Landfill Power production, SDG&E providing power
- Power plant online and available (no automatic dispatch), Running monitoring, forecasting and optimization tools – creating “lost opportunity report”

**Economic Mode**
- Grid Connected, Landfill Power production, SDG&E providing power
- Power plant available for automatic dispatch of generation assets, based on economic algorithms in various opportunity categories
  - Peak Optimization – system will keep track of each billing cycle with SDG&E and dispatch allocated generation in order to avoid the peak each month. Once peak has been avoided with new peak is created and generation will not dispatch unless necessary to avoid new peak (will not run if it does not have to)
  - Landfill Gas Back Up – allocated generation supports landfill power plant
  - Energy Optimization – allocated generation will run if the price of production is cheaper than price from WAPA/SDG&E
  - Demand Response – On notification from SDGE, battery storage will be used to participate in SDG&E DR programs; currently a CPUC rule prohibits use generators in these programs despite having prime permits.

**Test Mode**
- Half of the base remains grid connected, other half is powered in island mode with the power plant, landfill and other onsite generation
- Purpose is to “practice” and exercise the system for islanding to ensure that when called upon in an emergency that the system will function as designed
- Tests expected 1-2 times per year in conjunction with other operational readiness drills/activities for mission assurance
  - Reference DODI 4170.11, Energy Resilience (2) (b) 4. “DoD Components shall conduct full scale and routine testing…”

**Island Mode**
- “Blackout” SDG&E grid outage,
- Microgrid will use Power Plant to black start the critical loops at Miramar to create the microgrid island
- Microgrid will utilize as much renewable as possible while maintaining power quality
Thank you

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Back Up Slides
Building Microgrid Demonstration Phase 2
Island Results with Demand Limiting

- Max Building Load: 104kW
- Average Building Load: 77kW
- Max PV Penetration: 81.5%
- Average PV Penetration: 72%
- DLLR Level 2
- DLLR Disabled
- Auto Curtailment Active
- Initial Load Pick up
- Battery Power - Average 17kW
- Cooling Load After Load Shed
- End of Islanding Event
Landfill Gas Power Reliability

Landfill Power

Installation Load from SDG&E