FEDERAL UTILITY PARTNERSHIP WORKING GROUP SEMINAR

San Nicolas Island UESC Energy Conservation Projects

May 2, 2019 | San Diego, CA
SoCalGas
Gordon Maynard, Team Lead
Pride Metcalf, Project Manager

Introductions
» Roles
» Responsibilities

Island Overview

San Nicolas Island (SNI) is a US Navy owned and operated island. Located about 65 miles southwest of Point Mugu, it is the cornerstone in the Sea Range capabilities.

Due to its instrumentation, isolation and shoreline characteristics, SNI is ideal for conducting test and training exercises and for providing littoral warfare training, including tri-service and theater warfare exercises.
Goal: The Navy highly values energy resiliency and reliability aboard SNI.

The SNI Power Strategy had to address:

Prime Drivers:
- Resilient, renewable power
- Reliable infrastructure & power

Associative Benefits:
- Energy conservation
# Energy Conservation Measures

<table>
<thead>
<tr>
<th>Prime Drivers</th>
<th>Reliability</th>
<th>Associative Benefits</th>
<th>Energy Conservation</th>
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<tr>
<td><strong>Resiliency</strong></td>
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<tr>
<td>» Wind Turbine Generators (WTG)</td>
<td>» Hybrid System Supervisory Controller (SCADA)</td>
<td>» Generator Coolant Heater</td>
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<td>» Synchronous Condenser</td>
<td>» Generators’ Radiator VFDs</td>
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<td>» High Speed Load Bank</td>
<td>» Pool Thermal Solar</td>
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<td>» Diesel Generator</td>
<td>» Lighting retrofits</td>
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## Discussion Topics

- Setting
- Logistical Considerations
- Design Considerations
- Pre-construction Load Profile
- Energy Strategy

## Remote Location

- Point Mugu
- San Nicolas Island
- San Clemente Island
Appreciating San Nicolas Island’s Setting

San Nicolas Island
Wind Turbine Projects
Setting - Resource
Setting – Preservation

Fauna
Setting – Preservation (cont.)
Setting – Erosion and Slope Stability Realities
Setting – Location Considerations

- Soft landing zone
- Coastal Observation Assets
- Prevailing Wind
- Nicktown
- Airport - Airfield
- Powerhouse
- Wind Turbine Generators
- Soft landing zone
- Pier

Location
Logistical Considerations
Design Considerations

Location, location, location

» Determining the size and final placement of the wind turbine generators
» Given the previously mentioned constraints, and…
» Made in America

Navy’s 3 Pillars

Drivers:
» Reliability
» Resiliency

Associative Benefits:
» Energy Reduction & Efficiency
Design Considerations
SNI Typical *Pre-construction Load Profile*

**Notes:**
1. **Load Profile** – Typical daily use.
2. **Base Load** – lowest *safe* generator turndown.
**Resulting Energy Strategy**

**Resiliency & Reliability**

- Seven 100-kw wind turbine generators with custom 8-ft diameter by 16-ft deep pre-cast foundations
- Hybrid System SCADA primary and secondary controllers
- Synchronous Condenser & 160-kW Load Bank
- 2.2-miles underground 12-kV and fiber optic communications infrastructure
- Local and remote (powerhouse) control of wind turbine generators

**Energy Conservation Measures**

- 750-kW, 1,200-RPM reciprocating engine equipped with 1,000-kW alternator
- Thermal Solar Pool Heating System
- Hot water to Oil heat recovery system on all power plant generators, eliminating electric block heaters
- Variable Frequency Drives on all Generator radiators fans
- High-efficiency lighting retrofits
Resulting *Energy Strategy*
Wind Turbine Generators

**Nacelles** – manufactured in Vermont
- Direct drive generator
- 100-kW capacity rated
- Cut-in Speed: 7.8-mph
- Cut out Speed: 56-mph

**Blades** – manufactured in San Diego, CA
- Fixed pitch blade length: 30’
- Rotor diameter: 69’

**Towers** – manufactured in Wisconsin
- Tubular monopile in 3 sections
- Tower height: 117’
- Hub height: 121’
- Maximum height: 156’ (to tip of vertical blade)
- Internal ladder access to nacelle with emergency decent

**Foundations** – manufactured in California
- Precast concrete 16’ deep by 8’ Ø
Power Curve: 21-Meter Rotor

Average Wind Energy Production

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<th>mph</th>
<th>kW</th>
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<td><strong>Resiliency Pillar</strong></td>
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<tr>
<td>» Seven 100-kW Wind Turbines generating electricity above minimum generator output</td>
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<td>» New wind turbine switchgear that can accommodate a battery system</td>
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<td>» Five 1,000-kW generators (one new) with one in constant operation and four in “standby” mode, kept warm by the active generator’s recirculating hot water via individual hot water to oil heat exchangers</td>
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<td>» Fewer annual refueling barge runs - extended from monthly to 3 – 4 times per year (depending on operations)</td>
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<td>» Distributed, redundant, renewable power</td>
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<td>» Power factor improved from 0.5 to 1.0</td>
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<td>» High Speed Scada primary and secondary smart load controllers (HSSLC) that intelligently schedules and matches electricity load to generator(s), wind turbines, frequency condenser and load bank</td>
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<td>» Power outage and power quality issues are rare</td>
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Energy Conservation Benefits

**Energy Efficiency Pillar**

» Typical daily electricity profile reduced from 550 to 975-kW to 200 to 500-kW demand

» New generator minimum output – 160-kW as opposed to previous 500-kW

» Project cost - ~$21M

» Estimated simple payback: <20-yrs

» Estimated SIR >1.2

**Summary**

» These installed measures have proven to be successful

» But we are not finished – improved operational adjustments and tuning should yield incremental savings.

» Navy considering additional Energy Measures that improves this mission-critical, isolated micro-grid and further enhances its power resiliency and reliability
CLOSING COMMENTS

Andrew Baughman
NAVFAC SW Energy Program Director

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