FEDERAL UTILITY PARTNERSHIP WORKING GROUP SEMINAR

May 2, 2019 | San Diego, CA

San Nicolas Island UESC Energy Conservation Projects

SoCalGas

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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.

Navy Strategic Objective

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

Prime Drivers

Resiliency

- Wind Turbine Generators (WTG)

Reliability

- Hybrid System Supervisory Controller (SCADA)
- Synchronous Condenser
- High Speed Load Bank
- Diesel Generator

Associative Benefits

Energy Conservation

- Generator Coolant Heater
- Generators' Radiator VFDs
- Pool Thermal Solar
- Lighting retrofits

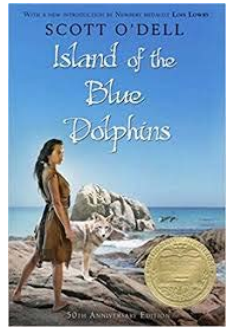
Presentation Overview

Discussion Topics

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

Remote Location

Appreciating San Nicolas Island's *Setting*



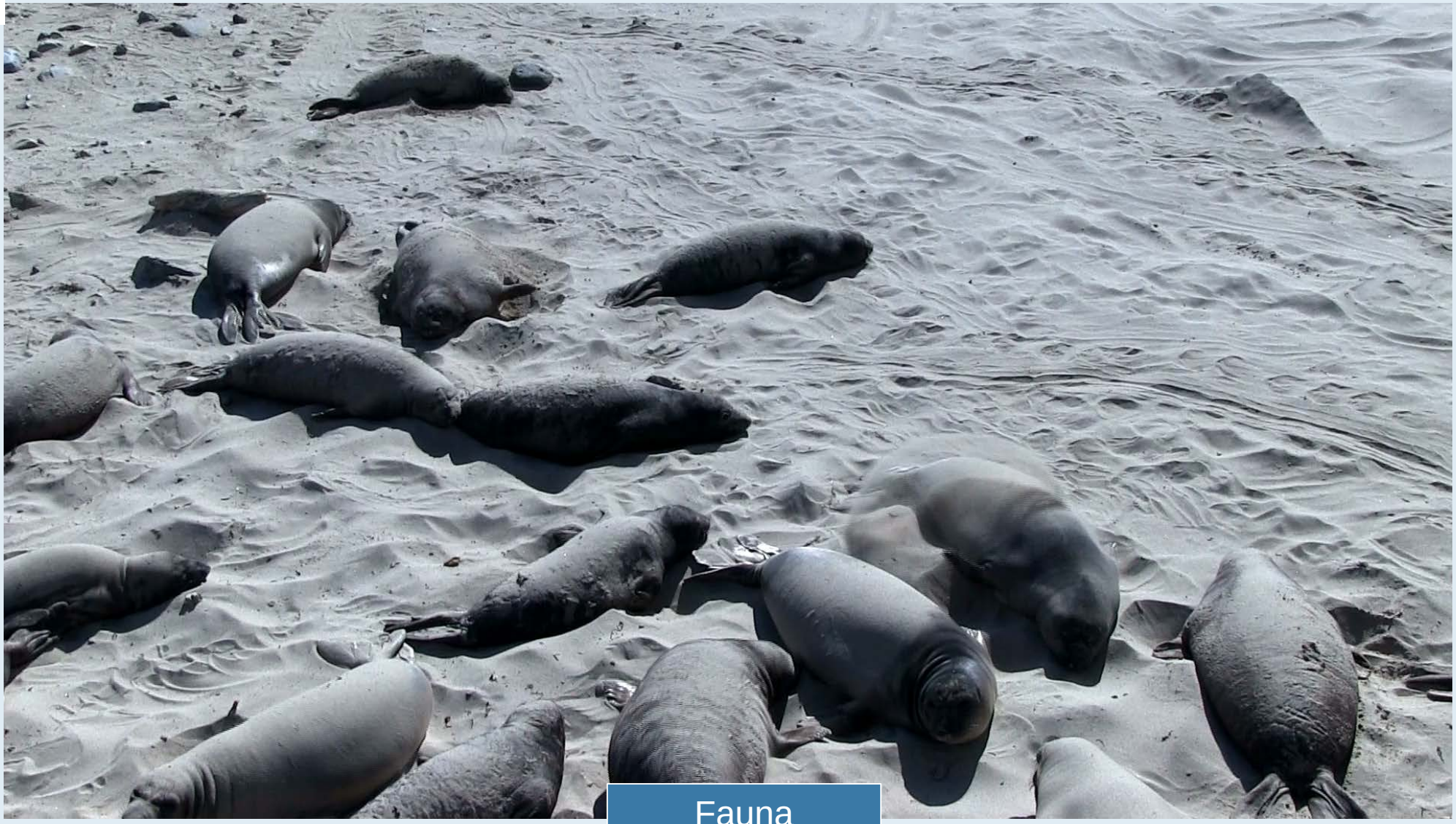
San Nicolas Island
Wind Turbine Projects

Setting

Setting - Resource

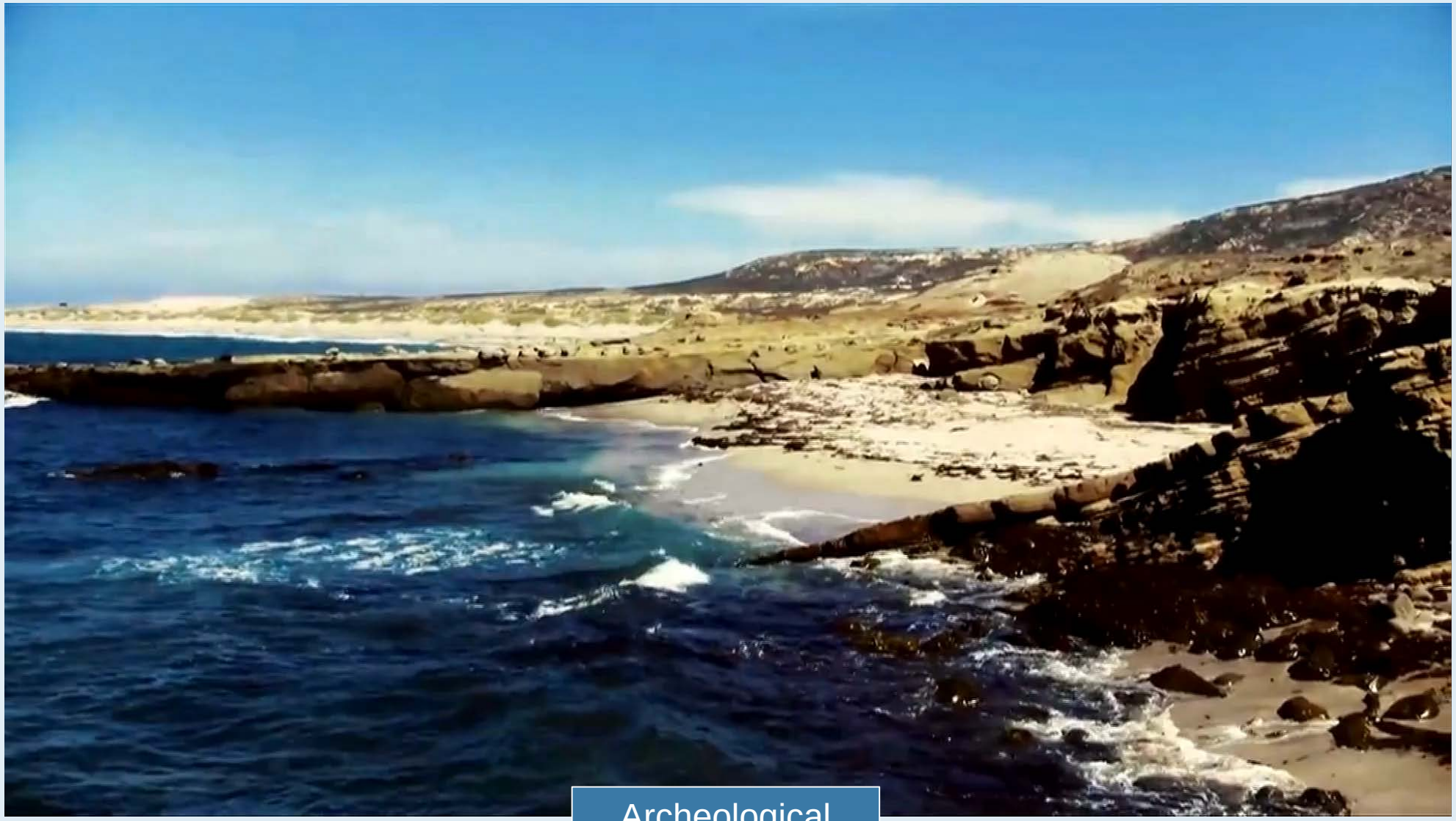
Wind Resource

Setting – Preservation



Fauna

Setting – Preservation (cont.)

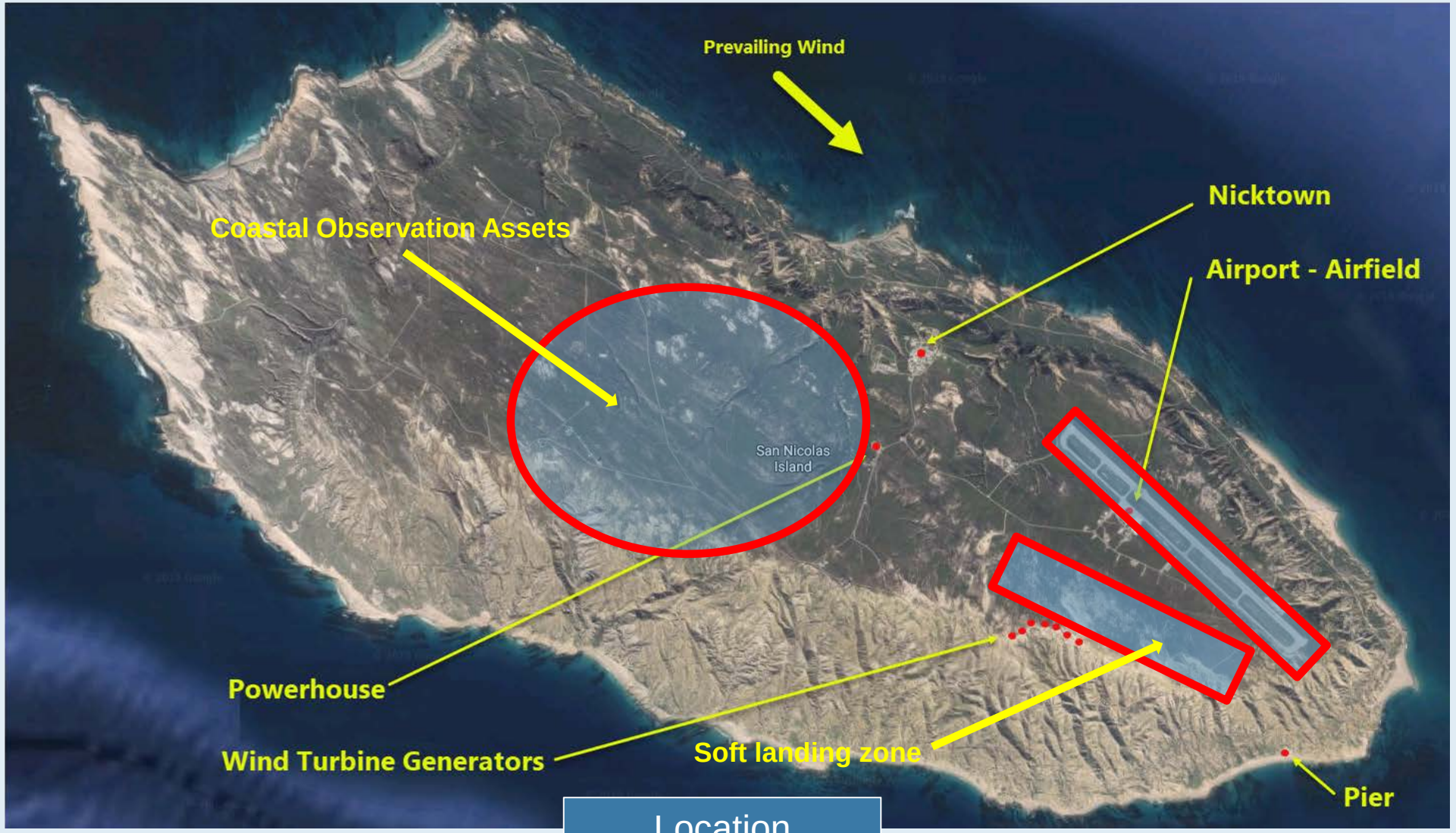


Archeological

Setting – Erosion and Slope Stability Realities

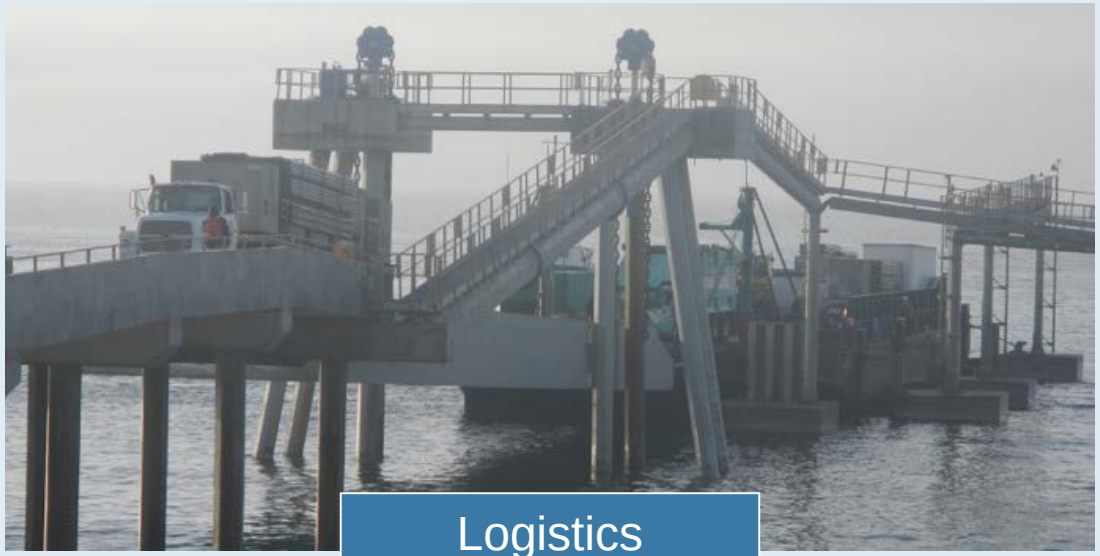
Environmental

Setting – Location Considerations



Location

Logistical Considerations



Logistics

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

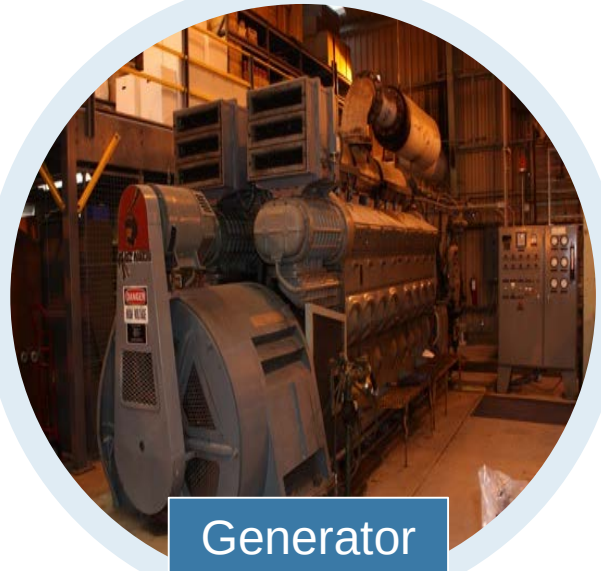
Associative Benefits:

- Energy Reduction & Efficiency

Design Considerations

Generator
1

Generator
3



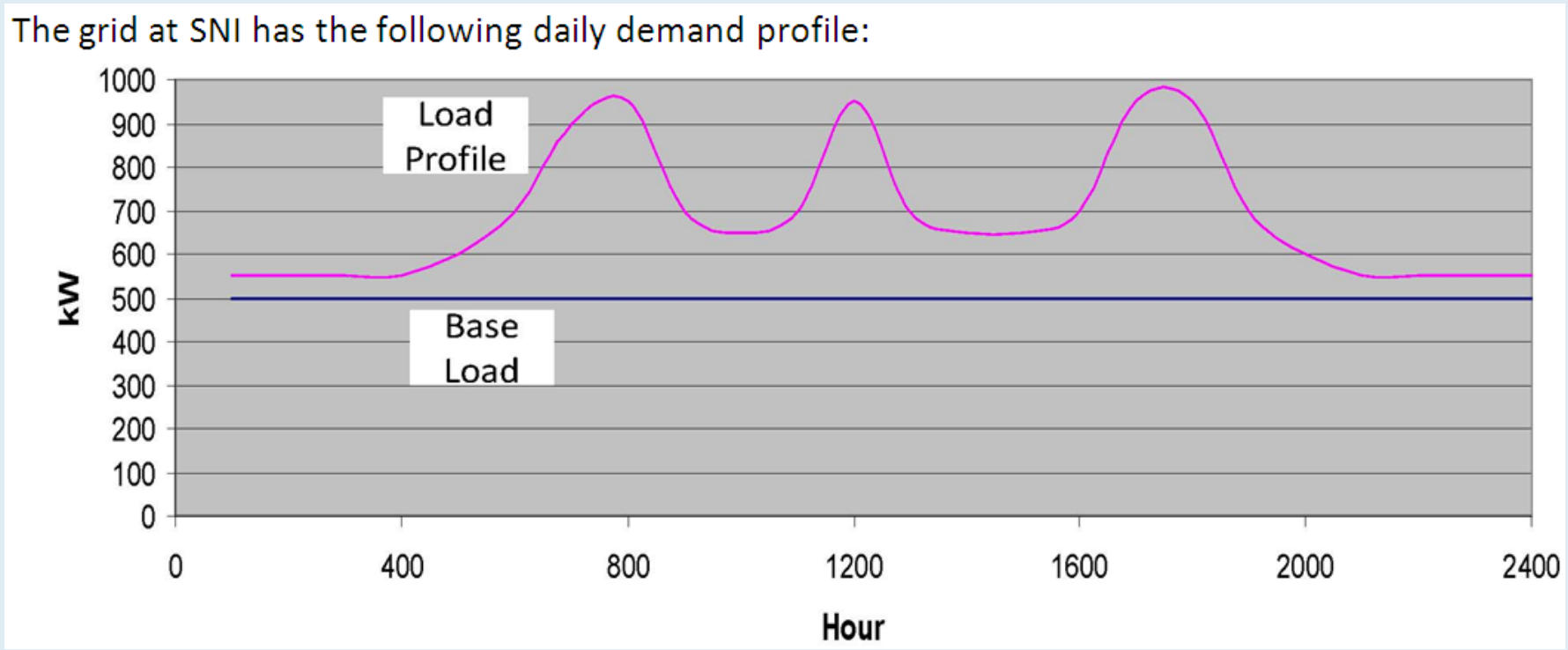
Generator
5

Generator
2

Generator
4

Drivers

SNI Typical *Pre-construction Load Profile*



Notes:

1. **Load Profile** – Typical daily use.
2. **Base Load** – lowest *safe* generator turndown.

Resulting *Energy Strategy*

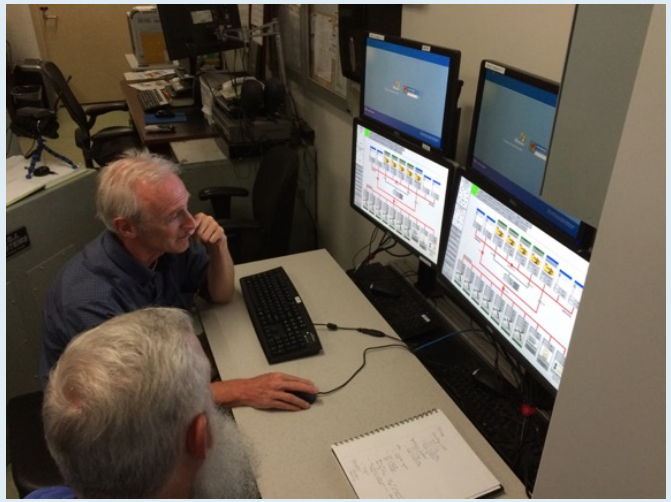
Resiliency & Reliability

- 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

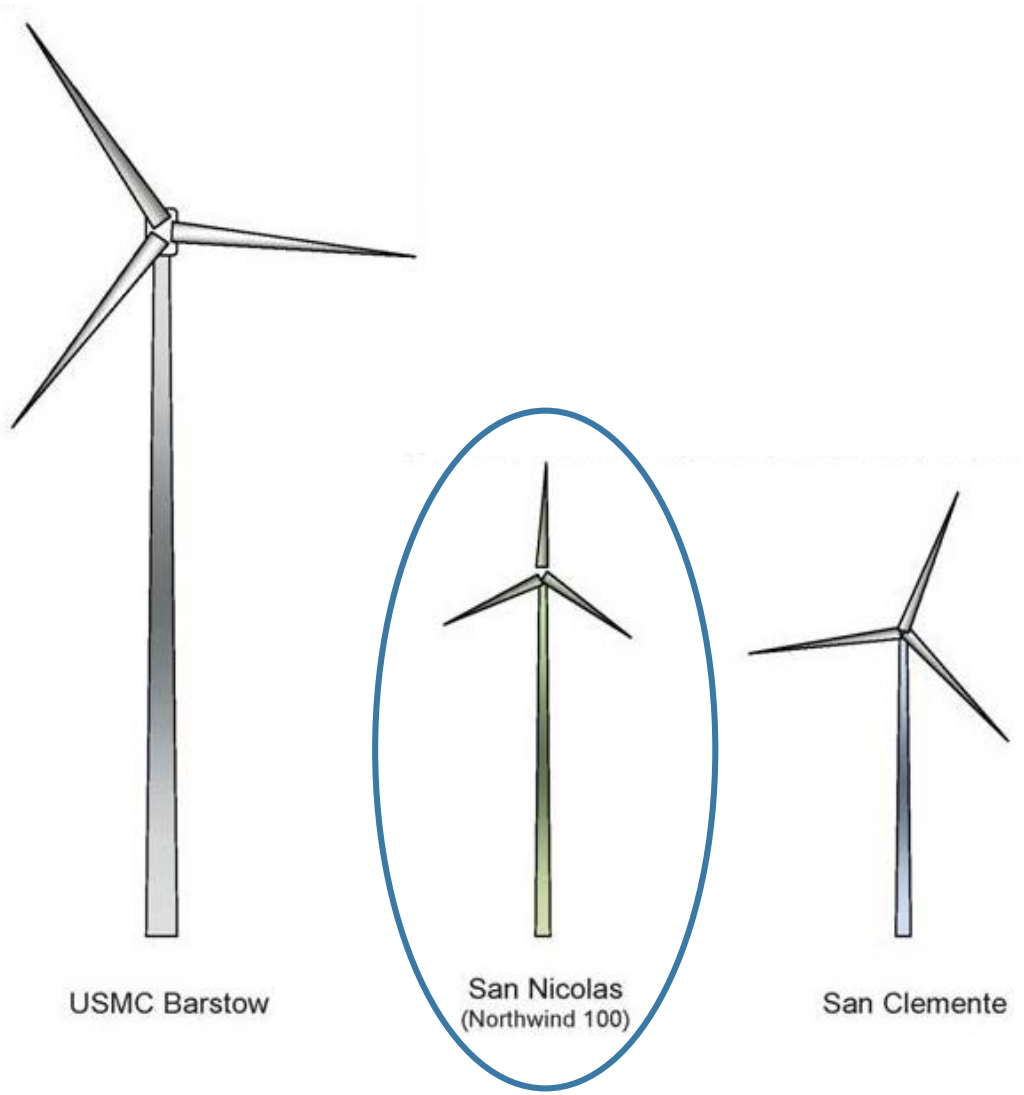
- Fixed pitch blade length: 30’
- Rotor diameter: 69’

Towers – manufactured in Wisconsin

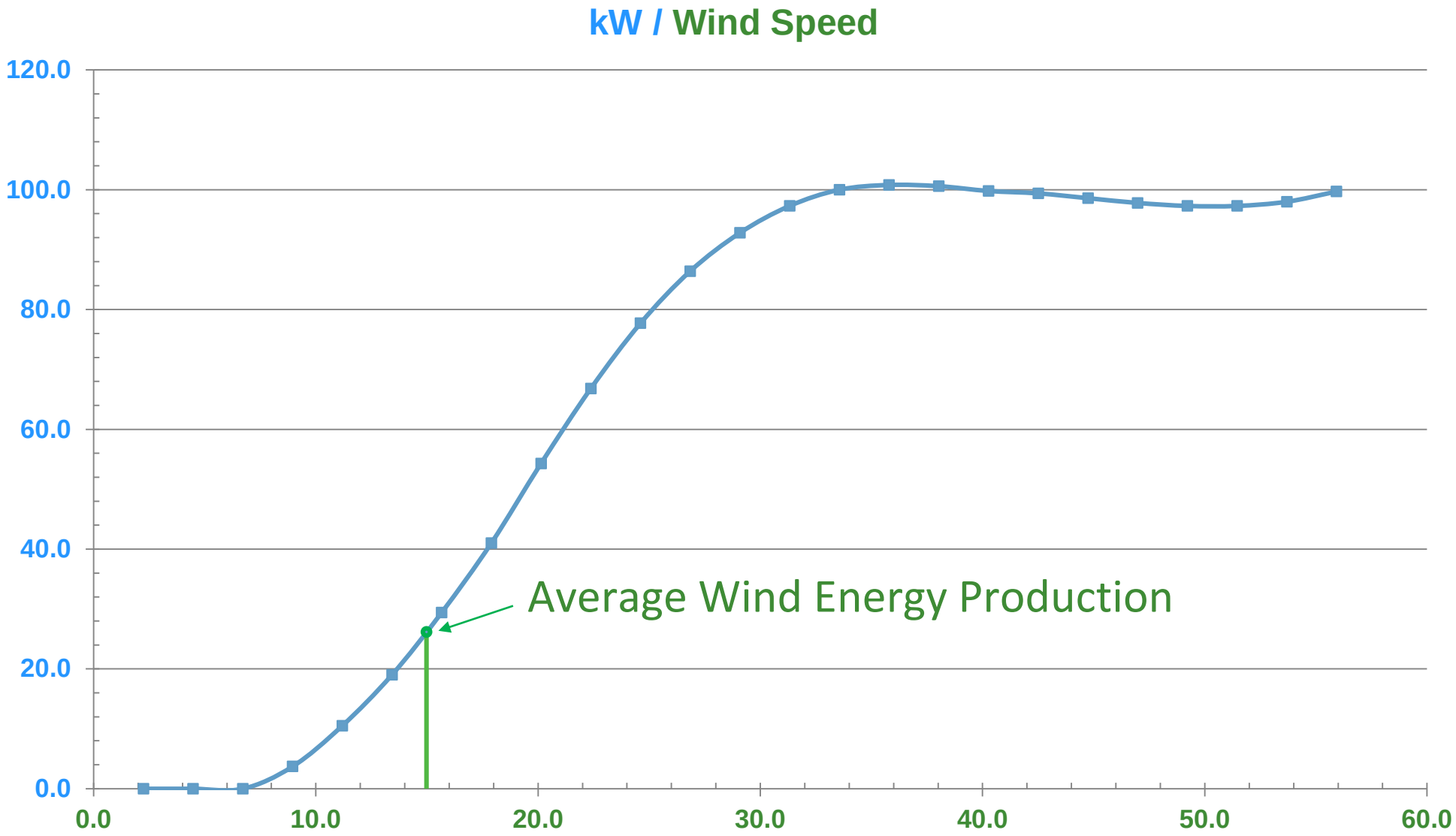
- Tubular monopile in 3 sections
- Tower height: 117’
- Hub height: 121’
- Maximum height: 156’ (to tip of vertical blade)
- Internal ladder access to nacelle with emergency decent

Foundations – manufactured in California

- Precast concrete 16’ deep by 8’ Ø



Power Curve: 21-Meter Rotor



mph	kW
2.2	0.0
4.5	0.0
6.7	0.0
8.9	3.7
11.2	10.5
13.4	19.0
15.7	29.4
17.9	41.0
20.1	54.3
22.4	66.8
24.6	77.7
26.8	86.4
29.1	92.8
31.3	97.3
33.6	100.0
35.8	100.8
38.0	100.6
40.3	99.8
42.5	99.4
44.7	98.6
47.0	97.8
49.2	97.3
51.4	97.3
53.7	98.0
55.9	99.7

Strategic Drivers – Results

Resiliency Pillar

- Seven 100-kW Wind Turbines generating electricity above minimum generator output
- New wind turbine switchgear that can accommodate a battery system
- 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
- Fewer annual refueling barge runs - extended from monthly to 3 – 4 times per year (depending on operations)
- Distributed, redundant, renewable power

Reliability Pillar

- Power factor improved from 0.5 to 1.0
- 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
- Power outage and power quality issues are rare

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

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