National Renewable Energy Laboratory

San Clemente Island, CA

Ed Cannon

Wind-Diesel Conference

September 23, 2002

Operated for the U.S. Department of Energy by Midwest Research Institute • Battelle • Bechtel

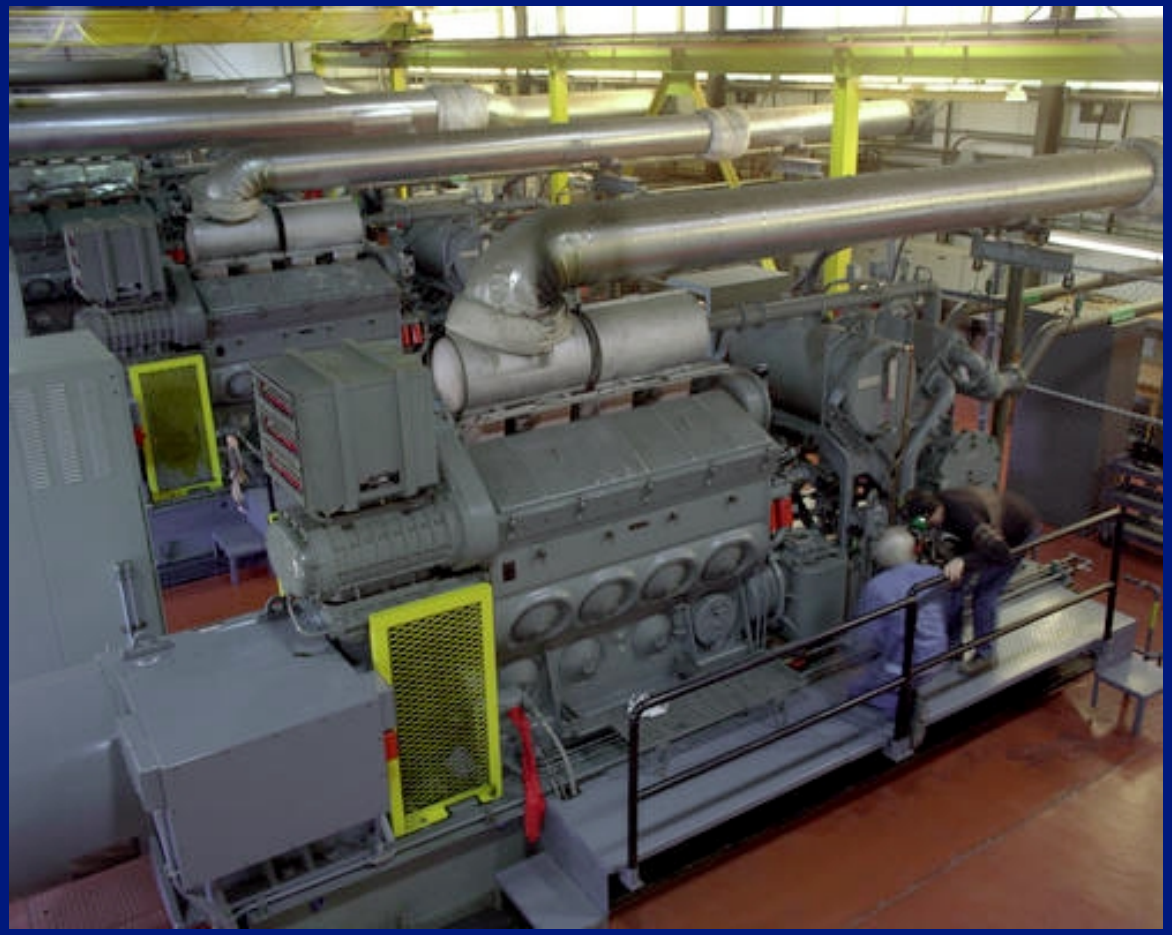
SCI

- 53 miles off coast
- Southernmost of Channel Islands
- Totally owned by U.S. Navy
- 34 miles long
- 1-4 mi. wide

Cantonment Area

Power Plant

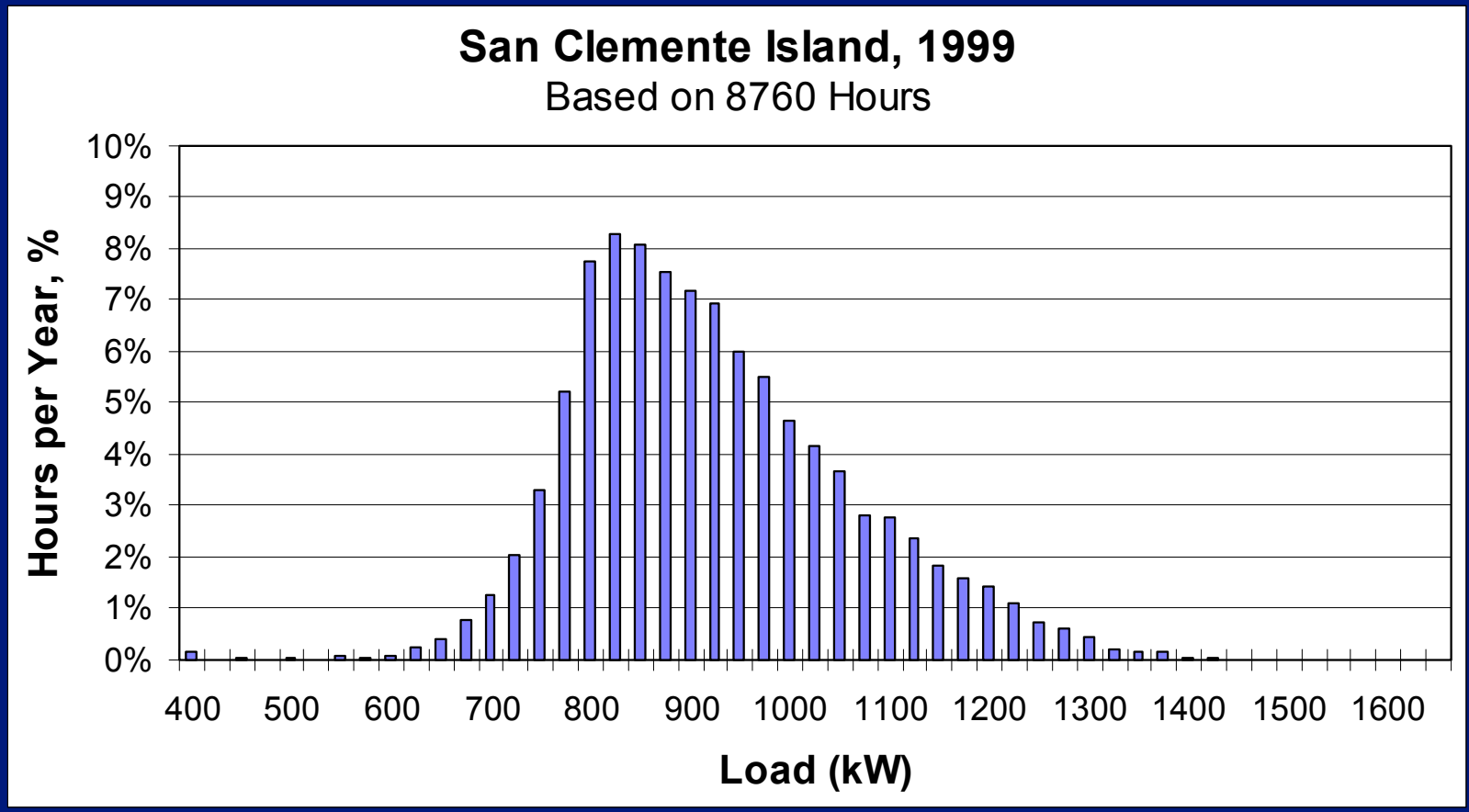
Four Diesel Generator Sets



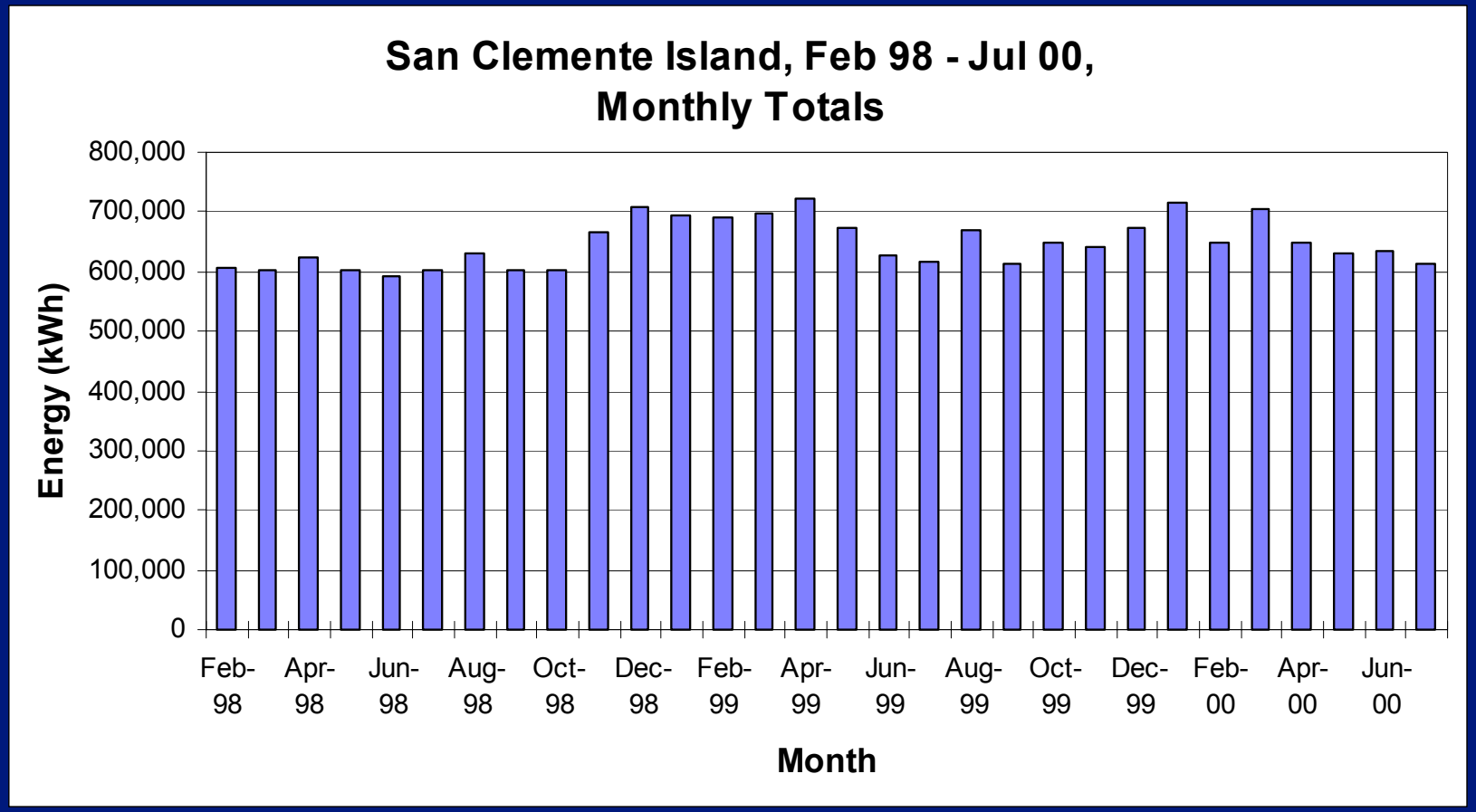
Diesel Generator Sets

Manufacturer & Model Diesel	Generator	Power Rating kW	Fuel Usage Full Load l/hr (gal/hr)
1. EMD 8-645E1	KATO (A258730000, 720 rpm)	500	144 (38)
2. EMD 8-645E1	KATO (A258730000, 720 rpm)	500	144 (38)
3. EMD 12-645E4	KATO (A257780001, 720 rpm)	1,200	329 (87)
4. EMD 12-645E1	KATO (A258710000, 720 rpm)	750	216 (57)

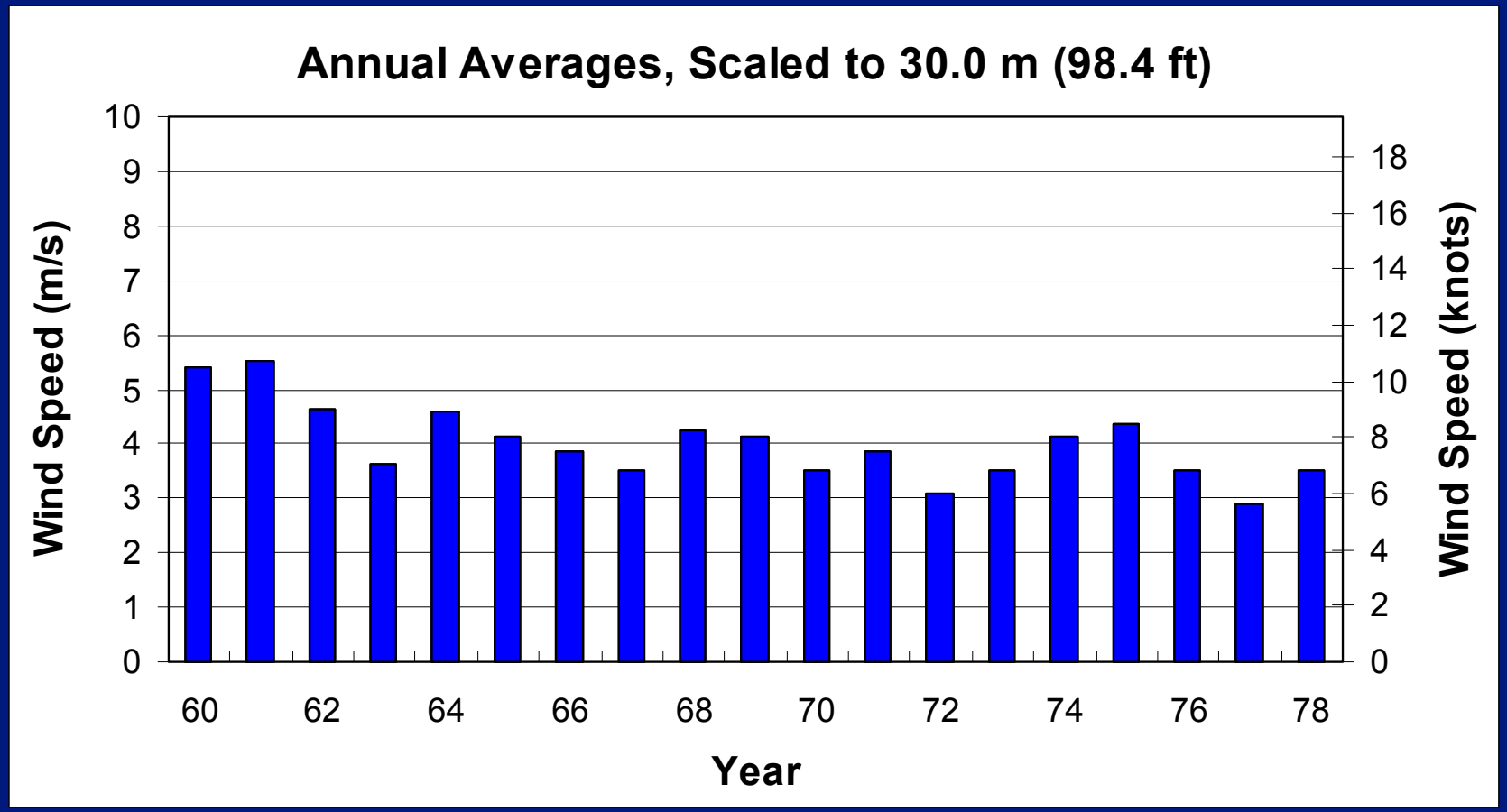
Electrical Load



Monthly Variation



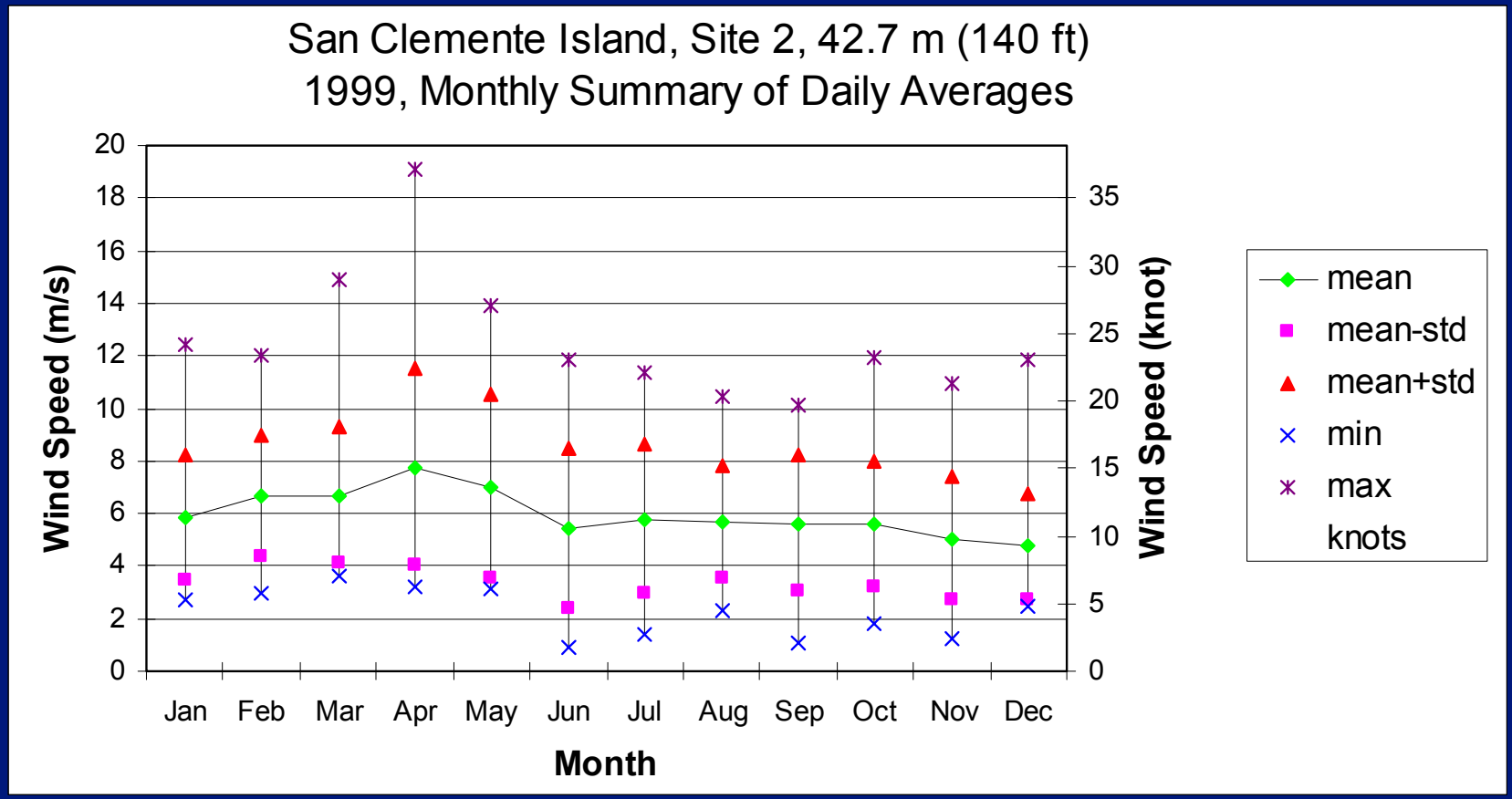
Historical Wind Data Low



Recent Wind Data Moderate

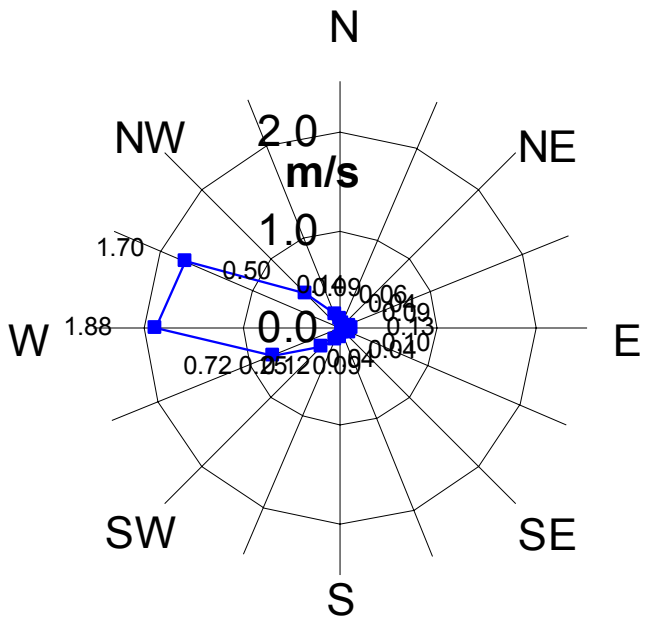
Year	Units	Avg	Dev	Min	Max
1996	m/s	6.1	2.7	1.8	16.9
1997	m/s	5.5	2.6	1.4	18.0
1998	m/s	6.6	2.7	2.3	17.0
1999	m/s	6.0	2.8	0.9	19.1
2000	m/s	6.0	2.5	1.1	13.6

Fairly Constant Much of Year

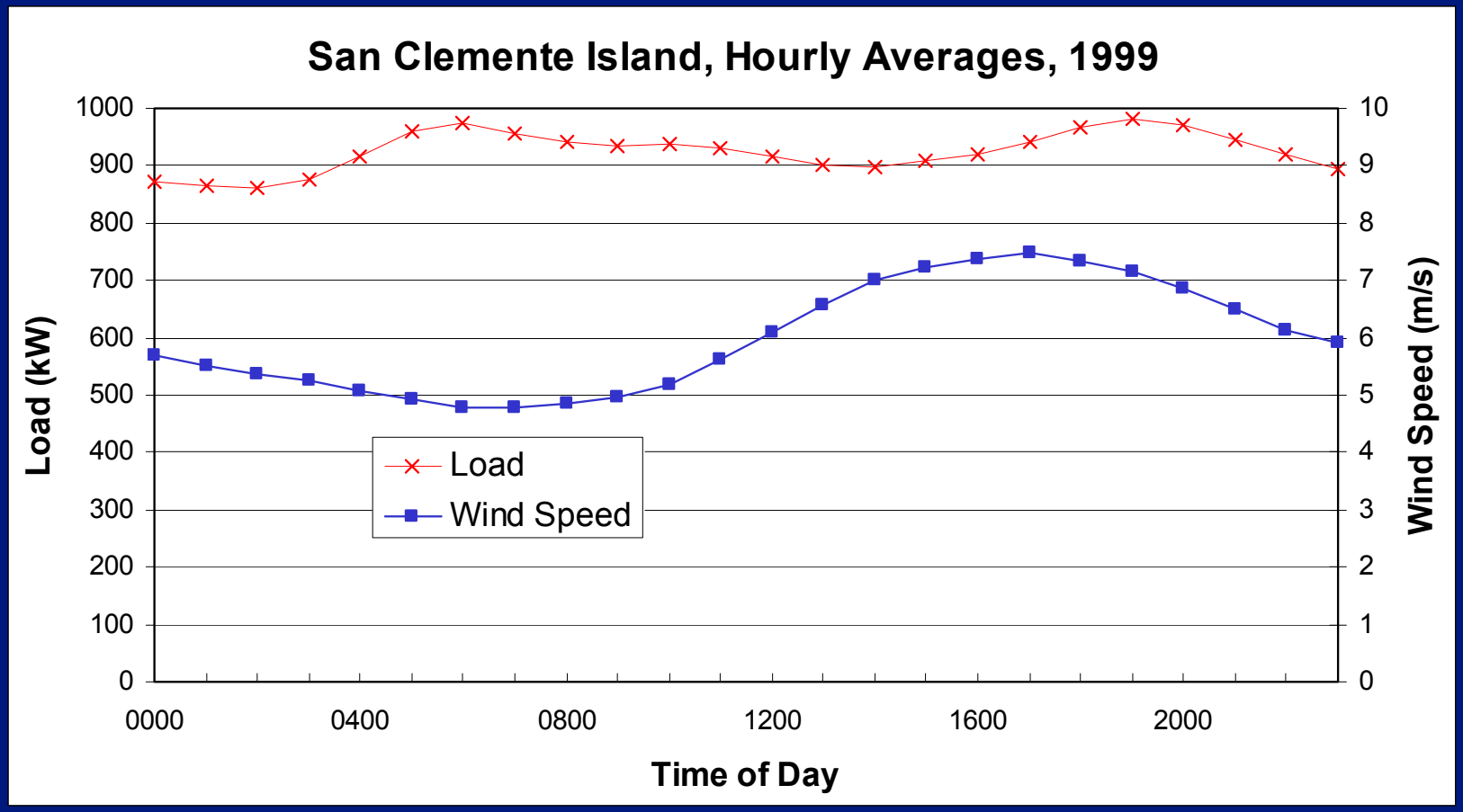


Most Usable Wind from West

Source Direction, True N, 1999
San Clemente Island, 42.7 m (140 ft), Met2

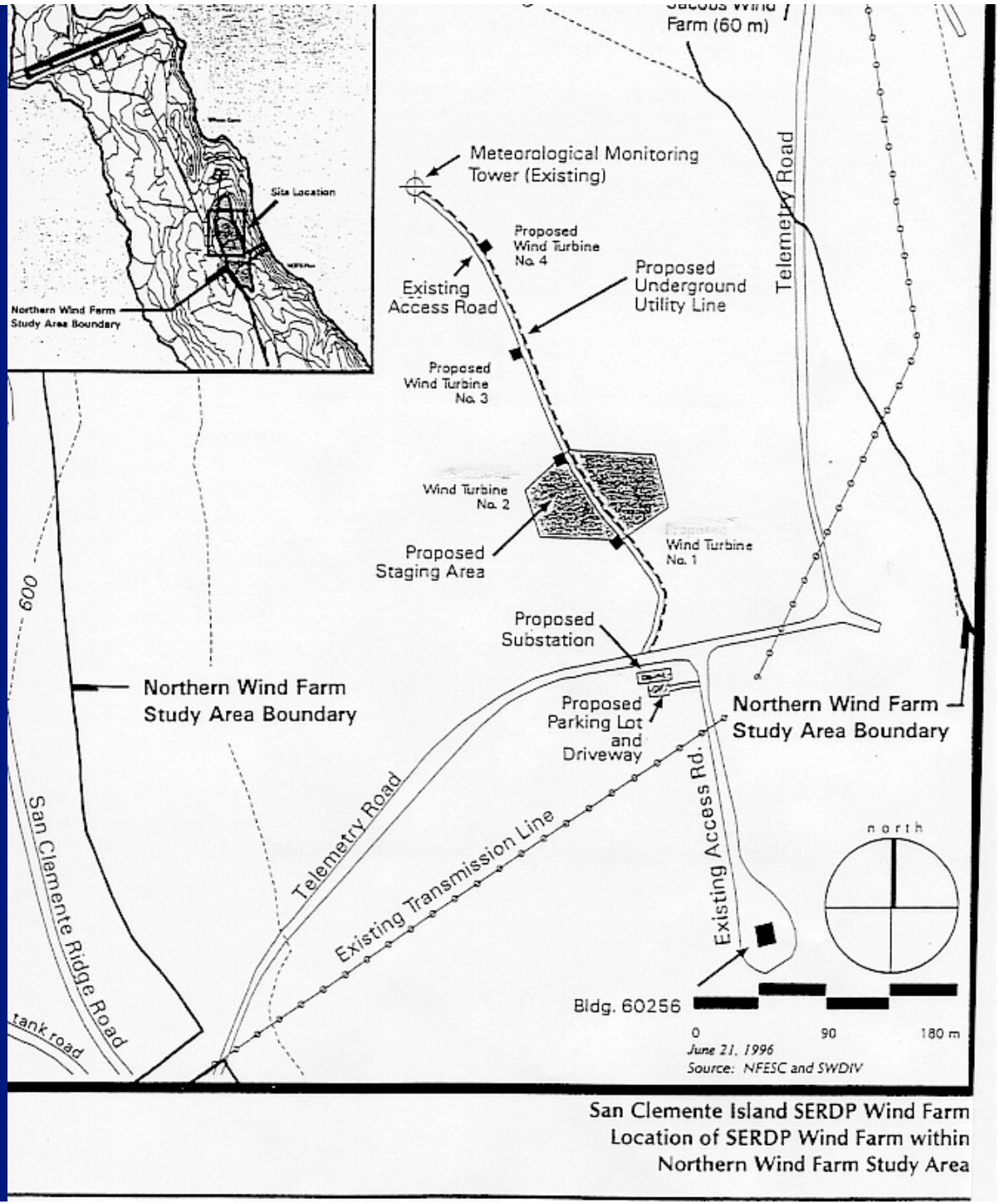


Neutral Wind/Load Correlation



Siting

- Multitude of Navy missions
- Thousands of archeological sites
- Endangered species
- Pristine waters
- Best winds (South) on bombing/shelling range
- Four sites permitted



San Clemente Island SERDP Wind Farm
Location of SERDP Wind Farm within
Northern Wind Farm Study Area

Three Turbines Installed

- Two NEG Micon 225/30 turbines on sites 1 & 2
  - SERDP funds
  - Installed Feb ‘98, commissioned Mar ‘98
- Additional NEG Micon 225/30 on site 4
  - FEMP funds
  - Installed Jul ‘99, commissioned Oct ‘99

NREL

System Performance

Parameter	Units	(11 mos) 1998	1999	(8 mos) 2000
Average WS, 1yr	m/s	6.6	6.0	6.0
Average Load, 1yr	kW	853	910	895
Avg. Net Diesel Load	kW	755	805	751
Energy Demand, 1yr	MWh	6839	7969	5242
Diesel Energy, 1yr	MWh	6053	7059	4398
Wind Energy, 1yr	MWh	786	910	845
Dump Load Usage	days	0	0	2
Diesel Energy	%	88.5	88.6	83.9
Wind Energy	%	11.5	11.4	16.1
Wind System Cap. Factor	%	22.1	21.3	21.4

Economics

- COE $0.193/kWh vs. $0.45 baseline
- Reduces overall system COE by 3.2%
- Simple payback period 8.6 years
- Internal rate of return 9.7%

Pollution Reduction

Pollutant	1998	1999	(Jan-Jul) 2000
NO_2	39,927	46,885	52,488
CO	8,601	10,100	11,307
SO_4	2,626	3,083	3,452
$PM\text{-}10_6$	2,807	3,296	3,690
CO_2	1,484,813	1,743,570	1,951,942
Aldehydes	634	744	833
TOC	3,259	3,827	4,285

Navy Adding Capacity

- Energy Conservation Investment Program (ECIP) funds
- Populate remaining site (Site 3)
- Seeking NEG Micon 225 to match other three turbines
- Power factor correction
- Possible load control
- Long-term talk of more capacity, pumped hydro storage

Questions?