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Subcontractor Report

Wind Power Plant Evaluation Naval Auxiliary Landing Field, San Clemente Island, California

Period of Performance 24 September 1999—15 December 2000

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Foreword

This report was prepared as part of a work-for-others funding contract sponsored by the Department of Defense (DOD) Naval Facilities Engineering Service Center (NFESC) under the U.S. Department of Energy (DOE) DOD Interagency Agreement, National Renewable Energy Laboratory (NREL) # IAG-98-1449.

The report expands on data collected, analyzed, and reported earlier in NREL/SR-500-24663, *Performance and Economics of a Wind-Diesel Hybrid Energy System: Naval Air Landing Field, San Clemente Island, California*, July 1999. It provides additional information on the wind resource, economics, and operation of the DOE wind turbines installed recently in conjunction with the existing diesel power grid for the Naval Auxiliary Landing Field, San Clemente Island (SCI), California, project.

The purpose of this report is to evaluate the wind power benefits and impacts to the SCI power system, including energy savings, emissions reduction, system stability, and decreased naval dependence on fossil fuel at the island. The primary goal of the SCI wind power system has been to operate with the existing diesel power plant and provide equivalent or better power quality and system reliability than the existing diesel system. The wind system is intended to reduce, as far as possible, the use of diesel fuel and the inherent generation of nitrogen oxide emissions and other pollutants.

The first two NEG Micon model NM 225/30 225-kilowatt (kW) wind turbines were installed on February 5, 1998, and commissioned March 31, 1998. A third turbine of the same design was installed July 5, 1999, and commissioned October 22, 1999. This report describes the SCI wind resource and operational data gathered from January 1999 through June 30, 2000, as well as the ongoing cost of energy provided by the wind turbines on SCI. Earlier data from 1995 through 1998 are presented in NREL/SR-500-24663, cited above. In support of this objective, several years of data on the wind resources of SCI were collected and compared to historical data. The wind resource data were used in economic and feasibility studies for a wind-diesel hybrid installation for SCI.

Because of their success with the current 675 kW wind turbine installation and subsequent receipt of the 2000 Federal Energy and Water Management Award, the Navy is considering future expansion of the SCI wind farm.

Acknowledgments

The authors wish to extend special thanks to the following major contributors to the success of this project:

Scott Davis (San Clemente Island [SCI] Utilities Supervisor) advised on all aspects of SCI facilities, costs, operations, and detailed breakdowns for the SCI diesel plant operations and costs. Diana Bendle (SCI Assistant of Operations), Randy Keatts and Jerry Mitchell (SCI power plant shift leaders), and the entire utilities staff assisted with this project in countless ways. Guy Urata (National Facilities Engineering Service Center [NFESC] Project Manager) and Brian Cable (NFESC SCI Project Engineer) provided general project support and logistics. Scott Miller (NFESC Instrument Engineer) assisted with SCI diesel data acquisition and reduction. Tom Brule (Public Works Center [PWC] Division Director at San Diego, now retired) made the site available for study, and Joyce Sengpaseuth (PWC Electrical Engineer) assisted with project logistics.

Executive Summary

In 1991, Congress authorized the Strategic Environmental Research and Development Program (SERDP) to help the U.S. Department of Defense (DOD) meet its environmental obligations. The SERDP efforts included the use of alternative energies to reduce emissions.

The long-term objectives of the U.S. Navy for San Clemente Island (SCI) are to install about 8 megawatts (MW) of wind capacity and to develop a pumped-hydroelectric storage system. San Clemente Island's electrical system is powered with diesel generators, using wind energy to reduce the overall diesel-system operating costs and emissions.

To accomplish this mission, the National Renewable Energy Laboratory (NREL), with the aid of the Naval Facilities Engineering Service Center (NFESC), was charged with collecting wind resource data, and then installing the wind turbine system. The first two wind turbine installations were funded through the U.S. Department of Energy (DOE)/SERDP; the third wind turbine was funded by DOE's Federal Energy Management Program (FEMP). This report summarizes the results of those tasks and the operational data acquired to date.

The annual average wind speed measured from August 19, 1995, through July 30, 2000 at the SCI wind turbine site is 6.0 meters per second (m/s) (11.7 knots). The National Renewable Energy Laboratory and NFESC take these readings from a 42.7-m (140-foot [ft]) meteorological tower.

This work continues a study of the operation of a wind-diesel hybrid system using three wind turbines as presented in report number NREL SR-500-24663 [1]. The study shows that wind energy can be cost effective in this application. Additional wind turbine installations may be limited at SCI, because the island has 7,000 protected archeological sites and other Navy facilities have priority. Higher wind potential is available at the southeast end of the island, however that region is used for a bombing range and is therefore off limits.

Using three 225-kilowatt (kW) wind turbines, the cost of energy (COE) of $0.197 per kilowatt hour (kWh) helps reduce the wind-diesel hybrid system COE by 5.6%. The simple payback period is 6.4 years, and the internal rate of return is 14.6%. Also, the three wind turbines have reduced average annual emissions by 15%. These numbers should improve with higher wind speeds or with additional wind turbines.

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1.0 Introduction

This report outlines and summarizes the local wind resource and evaluates the costs and benefits of supplementing the current diesel-powered energy system with wind turbines at the Naval Auxiliary Landing Field (NALF), on San Clemente Island (SCI), California. The electricity generated by the three 225-kilowatt wind turbines reduces the use of diesel fuel and provides diesel equipment cost savings by allowing for longer time periods between diesel maintenance schedules based on hours of runtime. It also reduces emissions of nitrogen oxides (NO_x), sulfur oxides (SO_x), particulates, and carbon dioxide (CO_2) that otherwise would be produced while generating the same amount of electricity using diesel fuel. The SCI project began with two operational 225-kW wind turbines on February 5, 1998, and the third turbine, installed between July and October 1999, was brought online October 22, 1999.

2.0 Background

2.1 San Clemente Island

Installation Setting: San Clemente Island is one of the Navy's largest real estate assets and is among its most unique installations. San Clemente Island is the southernmost of the eight Channel Islands located off the southern California coast, lying approximately 89 kilometers (km) (55 miles [mi]) southwest of Long Beach and 135 km (84 mi) northwest of San Diego. The next nearest landmass to SCI is Santa Catalina Island, lying approximately 40 km (25 mi) away between SCI and the mainland. San Clemente Island's geographical center is 32°54' N, 118°29' W.

The Island is approximately 34 km (21 mi) in length, with a land area of about 148 km^2 (57 mi^2 or 35,540 acres), making it one of the larger Channel Islands (see Figure 1). The rugged southern third of the island has an average width of about 6.4 km (4 mi), with the remainder tapering to 1.6 km (1 mi) across at the flatter and lower north end.

San Clemente Island is considered the most biologically and historically distinctive coastal island owned by the United States. The island supports unique natural, cultural, and anthropologic resources as well as a variety of activities for naval operations and training.

The island, generally treeless, is relatively flat on top and drops off sharply on the east side with a more gradual slope to the ocean on the west side. The interior terrain is a rolling mesa, with little vegetation, mostly coarse grasses and few large shrubs. The Island's highest point, Vista View Point, is 592 meters (m) (1,943 feet [ft]) at the southwestern portion of SCI.

The SCI wind turbine site (see Figure 2) is located along Telemetry Road in the island's north-central portion (33°59' N, 118°53' W).

Prevailing winds on SCI are from the west and northwest and are moderate and steady most of the year. The average wind speed at the wind turbine site is 6.1 meters per second (m/s) (11.8 knots) and seasonal variation is small.

Climate: The Island's climate is distinctly maritime, with cool summers and mild winters. Except for fog, overcast conditions, and generally cooler year-round temperatures, the weather is similar to that of the southern California mainland coastal region [2].

Temperature: One of the outstanding features of SCI's climate is the narrow temperature range, with mean winter temperature just 12.2°C (10°F) lower than the mean summer temperature. Mean annual temperature at the lower elevations is about 15.6°C (60°F), 16.6°C (62°F) at the higher elevations. Temperatures above 32.2°C (90°F) are rare, but occasionally, when Santa Ana wind conditions occur between August and October, temperatures of 32.2°C (90°F) and even 37.8°C (100°F) have been recorded. No temperatures below freezing have ever been recorded at the location of the airfield station, but at the higher elevations such as Mt. Thirst such temperatures appear to occur, according to the Navy-based public utility crews.

Humidity: High relative humidity is experienced throughout the year with an annual average of 78%. The exception occurs during Santa Ana conditions when the relative humidity is generally less than 25% [1].

Winds: Gale-force winds are common at higher elevations during the winter, but are infrequent elsewhere on the Island. Average wind speeds measured at the airfield are less than 5 m/s (10 knots). The airfield sits at a low elevation next to a rise in the land, which can deflect or shelter the wind.

Precipitation: Annual precipitation averages just 13–20 centimeters (cm) (5–8 inches [in]), with the majority falling between November and April, and the driest period being June to September. Snowfall has been reported at the highest elevations on the Island, Mt. Thirst and Mt. Vista, but in minimal amounts. Occasionally small hail accompanies the passage of strong storm fronts [2].

2.2 Naval Installation Mission

The Naval Auxiliary Landing Field located on SCI serves a variety of weapons research, development, testing, evaluation, and military training functions. It is used primarily by several major Naval tenant commands, but is also used by research divisions of government agencies and private companies working on government contracts. San Clemente Island is administered by the Commanding Officer, Naval Air Station North Island. The Island's relative isolation, restricted airspace, variable topography, adjacent

deep seas, and clear water conditions permit a great deal of flexibility in accommodating specific testing and training programs [2].

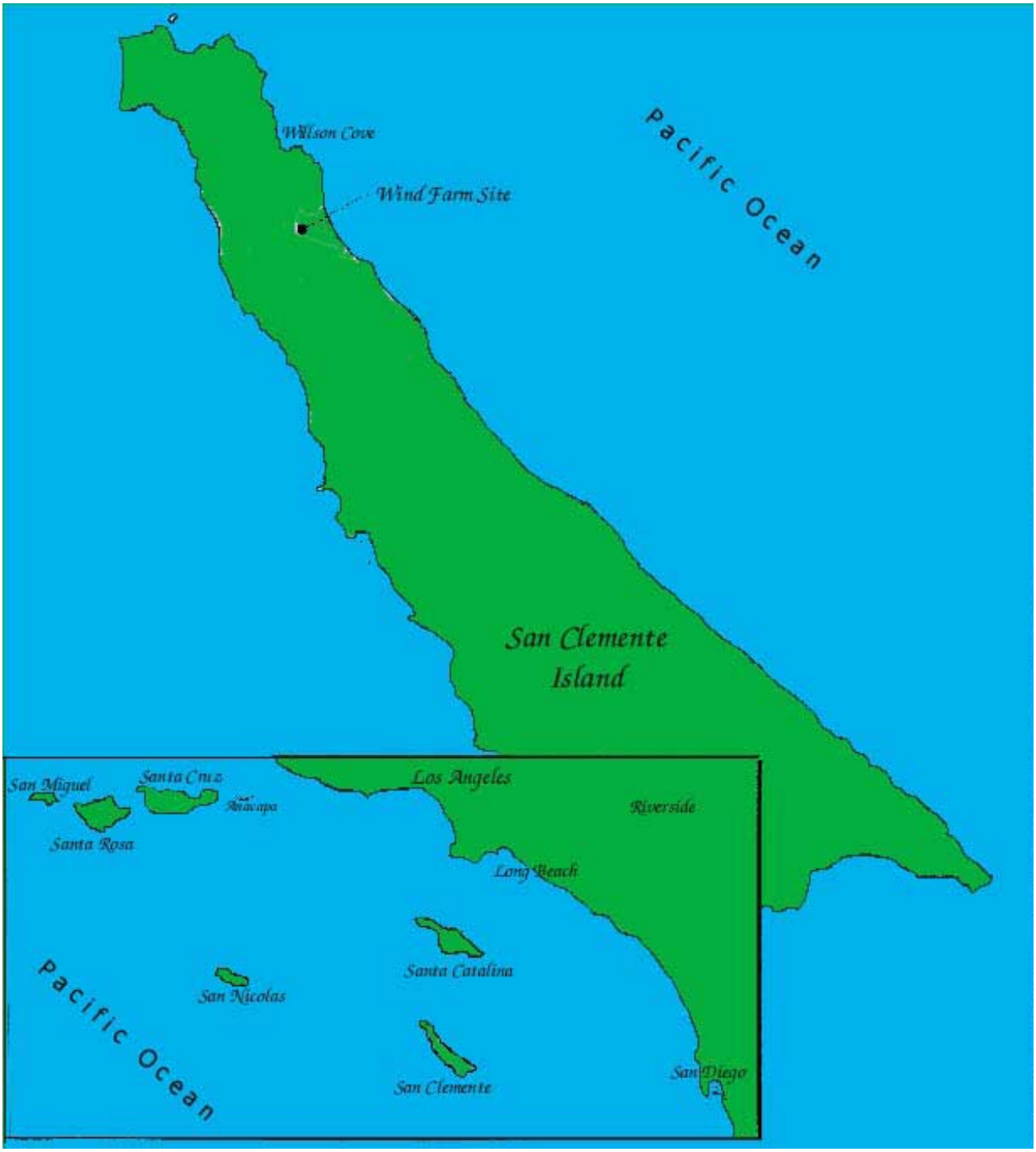


Figure 1. SCI location map. ***Source: San Clemente Island Site Manual***

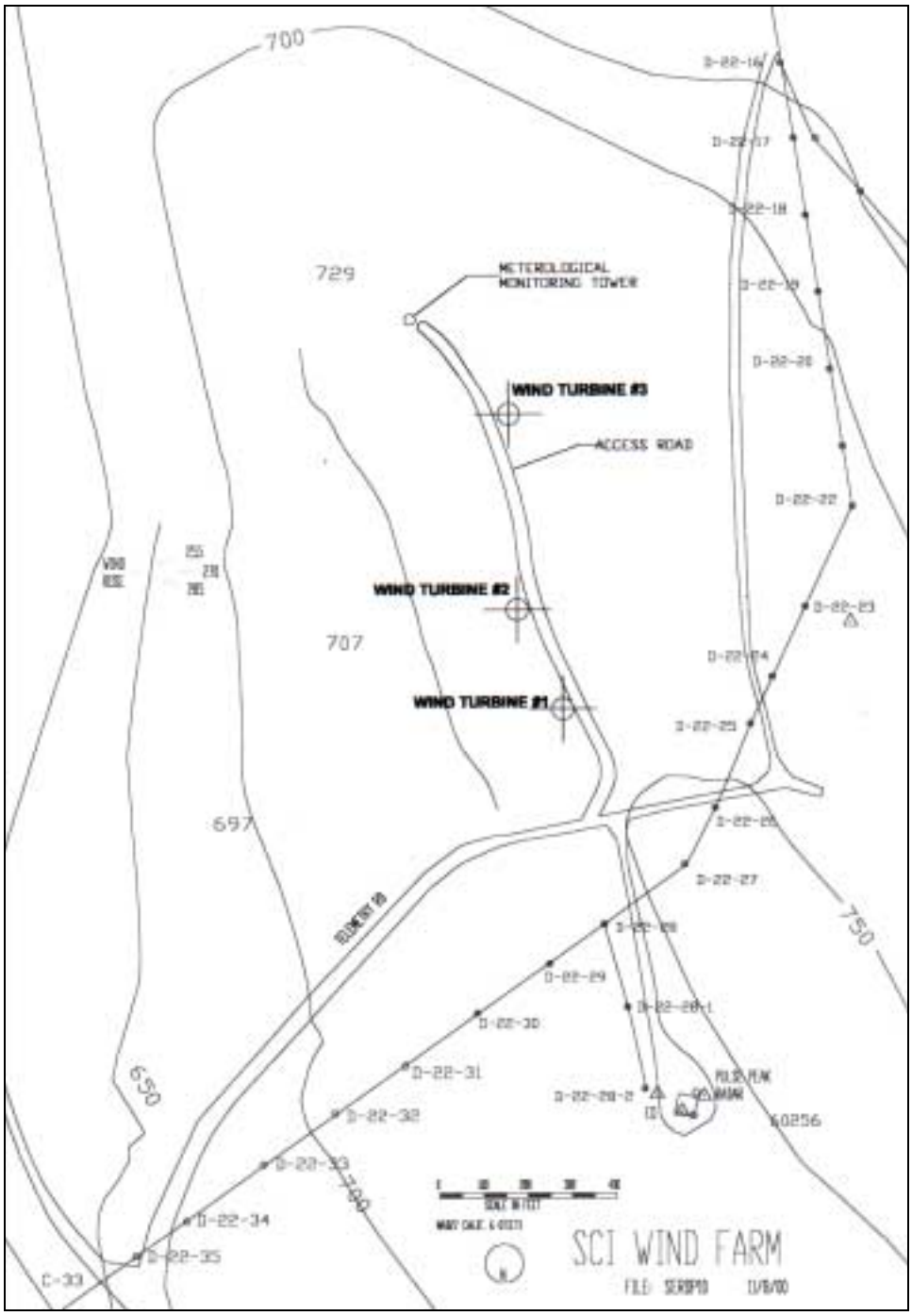


Figure 2. SCI wind farm location map. ***Source: USN NFESC and SWDIV Environmental Assessment Report***

2.3 Energy Demand

The energy production information that follows in Table 1 is based on a summation of 1-minute diesel production data and the wind turbine power curve applied to 10-minute wind speed data. The current (1999 and 2000) average hourly electrical demand at SCI is 900 kW; the hourly average peak was 1508 kW. The SCI combined diesel and wind turbine electrical power production supplied 7.97 million kWh in 1999, up from 6.15 million kWh in 1996.

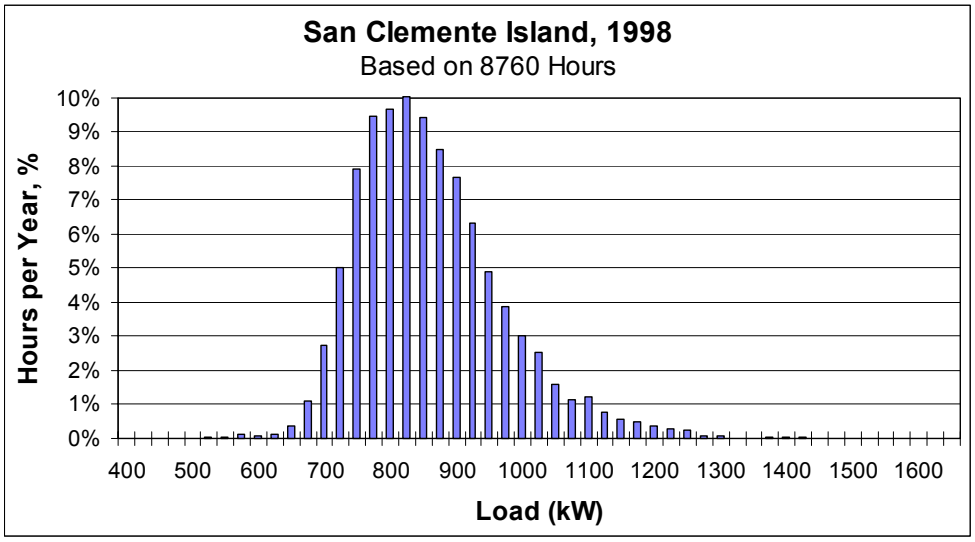
Table 1. SCI System Demand Statistics

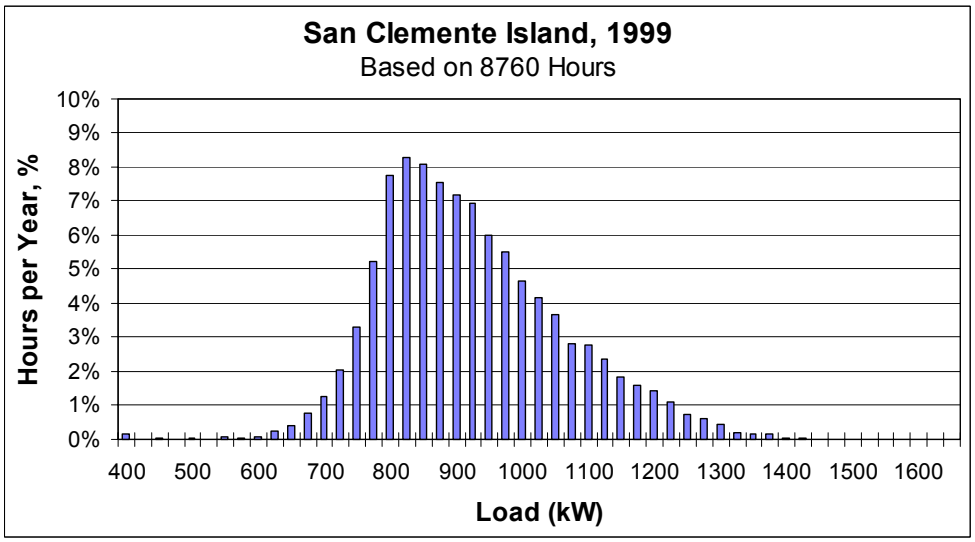
Parameter	Units	Year: 1996	1997	1998	1999	(8 mos) 2000
Peak daily production	kWh	22,400	25,900	26,788	30,984	29,970
Low daily production	kWh	12,250	14,000	13,650	10,004	15,350
Average hourly production	kWh	702	774	847	910	902
Average daily production	kWh	16,842	18,580	20,320	21,834	21,638
Average monthly production	kWh	512,269	565,146	618,080	664,123	657,264
Peak monthly production	kWh	547,100	724,150	708,438	720,944	714,594
Low monthly production	kWh	478,000	523,250	591,827	613,297	611,744
Annual energy production	kWh	6,147,230	6,781,750	7,416,959	7,969,483	5,258,115
Annual energy from diesel	kWh	6,147,230	6,781,750	6,631,021	7,058,736	4,413,400
Percent energy from diesel	%	100	100	89.4	88.6	83.9
Fuel consumption	liter	1,983,120	2,033,260	2,074,240	2,277,786	1,322,384
Fuel consumption	gal	523,942	537,190	547,958	601,793	349,375
Diesel energy/fuel ratio	kWh/l	3.10	3.34	3.20	3.10	3.34
Diesel energy/fuel ratio	kWh/gal	11.7	12.6	12.1	11.7	12.6
Production growth	%	–	10.3	9.4	7.4	~ -1.0

Source: SCI Public Works Center Records

The load frequency distribution in Figure 3 shows predominant operation between 800 kW and 1000 kW, with peaks up to 1500 kW. Annual diurnal loads are shown in Figure 4. These figures are based on the composite data set using January 1, 1999 through August 31, 2000 loads data. Included with the data set are daily energy production and monthly fuel consumption. Both figures reflect the growth in average load from about 850 kW in 1998 to 900 kW in 1999 and 2000. Peak loads and standard deviations were relatively unchanged. Annual records of monthly energy production and fuel consumption are shown in Figures 5 and 6, and the relationship between the two in Figure 7.

The power plant recorded daily load data, including total load and the energy produced by each of the diesel generators and wind turbines. These data were used to generate monthly statistics and records. In addition, 1-minute diesel data were monitored and stored by a separate computer managed by Naval Facilities Engineering Service Center (NFESC), and averaged to provide hourly data. Unfortunately, project funding did not allow for fully automatic 1-hour (or faster) data collection at the wind turbines. Because wind turbine production was not collected on an hourly basis, it was estimated from the 10-minute wind speed data and the wind turbine power curve. The total estimated energy production was then used for the load frequency distributions and diurnals. The 1-minute diesel data were 97% complete in 1999 and 88% complete in 2000.





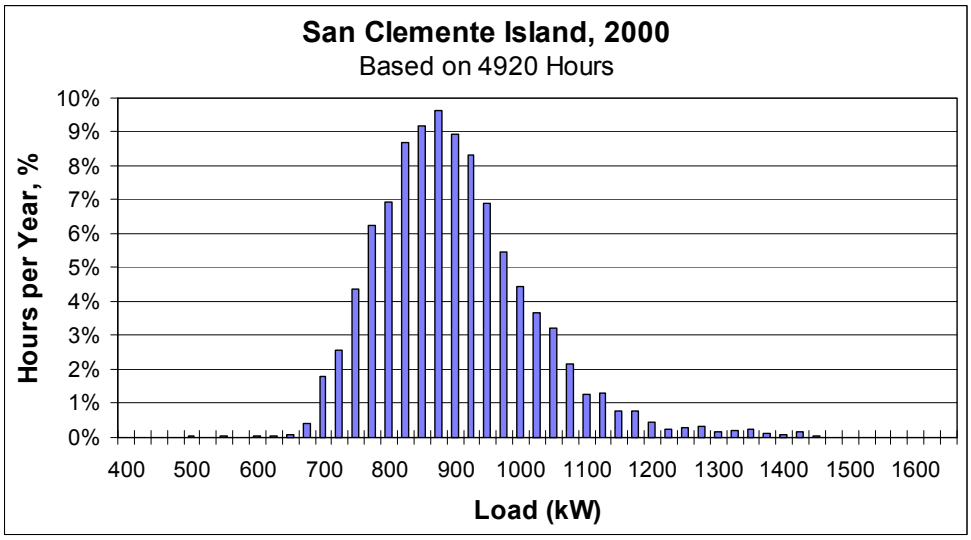
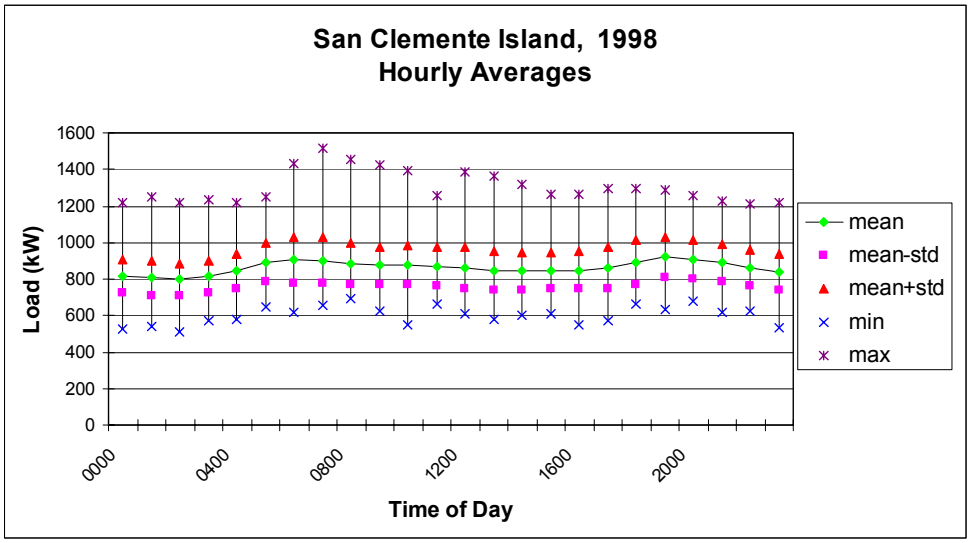
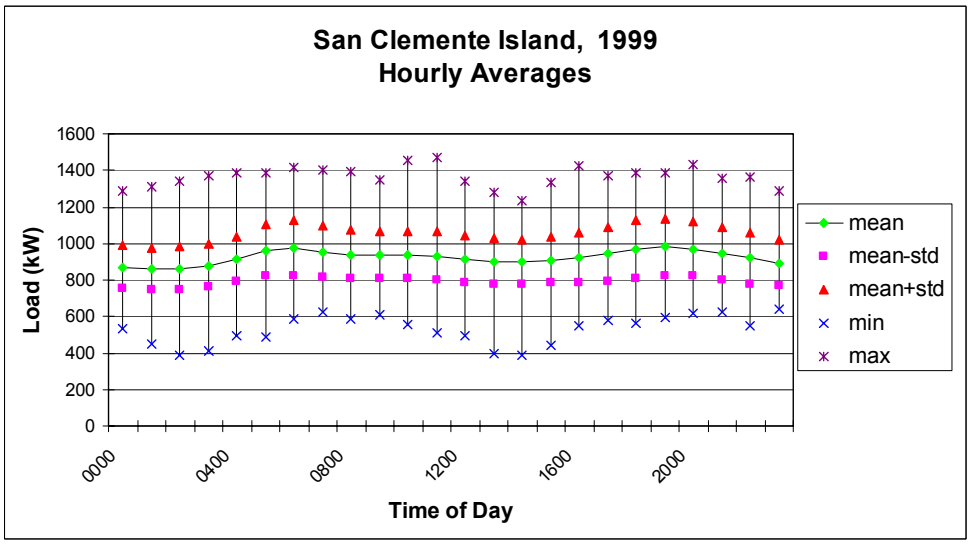


Figure 3. SCI load frequency distributions.





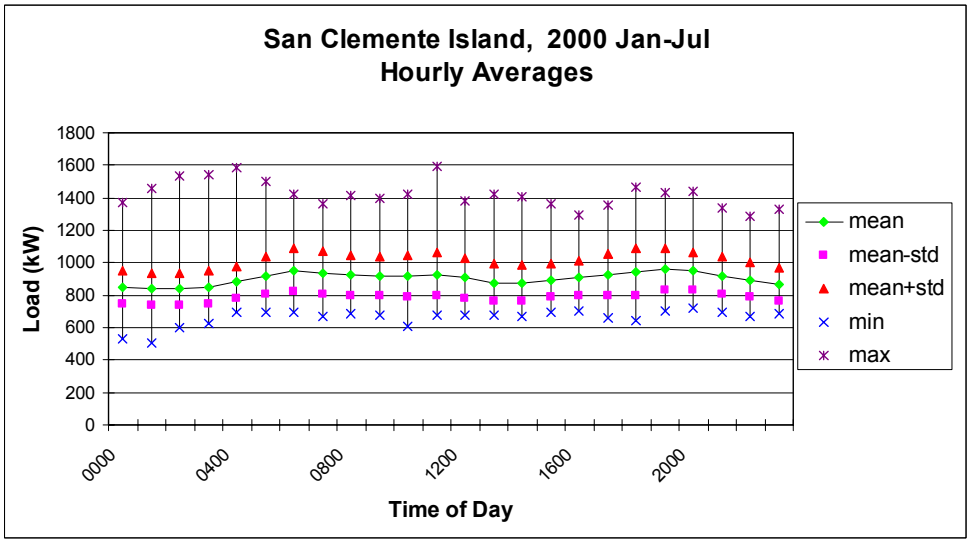


Figure 4. SCI annual average diurnal load.

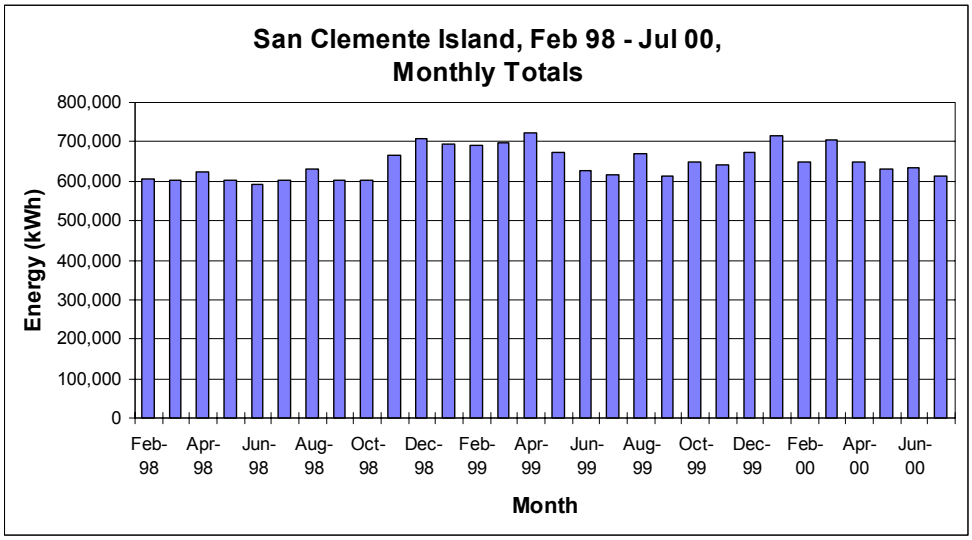


Figure 5. SCI annual energy load history.

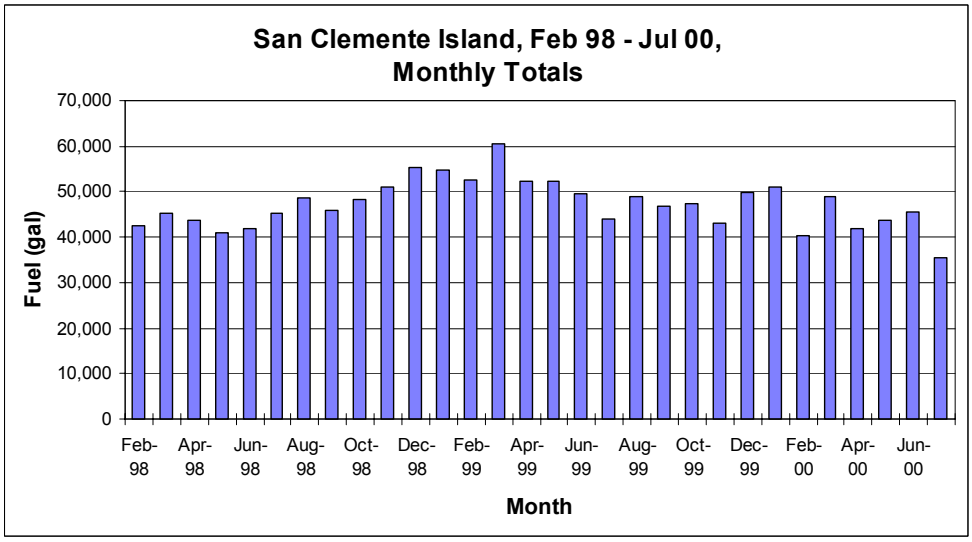


Figure 6. SCI annual fuel consumption history.

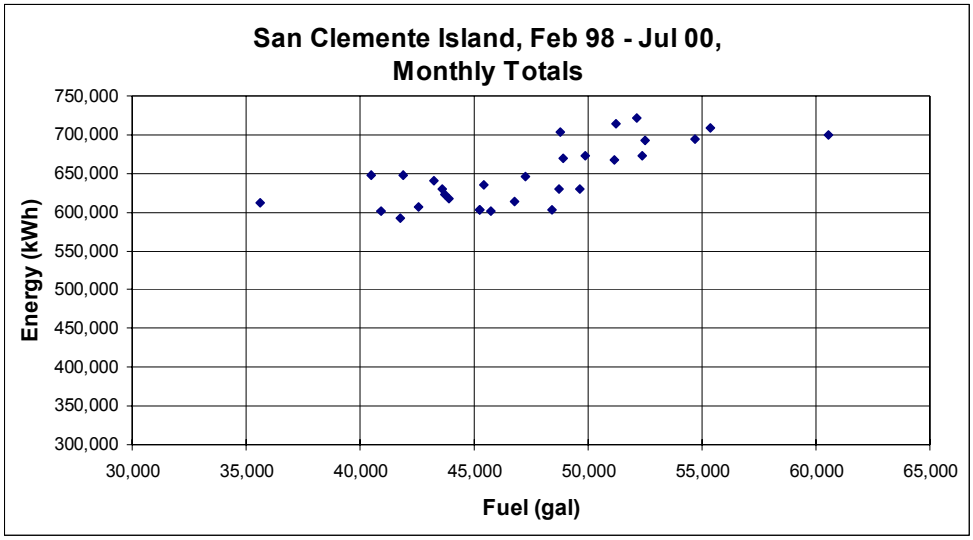


Figure 7. SCI energy production vs fuel consumption.

2.4 Wind Energy Site Description

The wind energy site is located along Telemetry Road in its north-central portion (33°59' N, 118°53' W), as shown in Figures 8 and 9. The highest elevation at this location is 222 m (730 ft). The terrain follows a smooth fetch from the prevailing WNW wind, with the turbines located along the island's north-south ridgeline.

The wind farm site is surrounded and dominated by open, undeveloped habitats. Telemetry Road runs east-west through the wind site and a Navy building is located roughly 300 m (985 ft) to the south.

There are no trees or other wind obstructions on the site, only light vegetation including grasses and cacti. Several low-water tanks and buildings, including the Power Plant Island Utilities, are located to the north and on lower elevations from the wind turbine site. The nearness of the power plant (approximately 3.2 km or 2 mi) minimizes power line distances to the wind energy site.

This site has moderate winds throughout the year. Although more optimal wind-site locations exist on the southern section of the island at higher elevations, this particular site was selected to avoid environmental and anthropologic constraints, as well as to avoid interfering with radar, communications, or other naval weapons testing operations. After two years of operating the wind turbines, no such interference has been reported.

Figure 8. Aerial view of naval facilities and wind turbine site. ***Source: NREL Aerial Photograph***

Figure 9. Aerial view of north end of island with wind turbine site. ***Source: NREL Aerial Photograph***

3.0 The Wind Resource

3.1 Wind Data Collection and Analysis

In July 1994, the National Renewable Energy Laboratory (NREL), entered into a cooperative agreement with the NFESC to collect one full year of high-quality wind energy resource data at the SCI old Jacobs wind turbine facility (Tower #6) at 18.3 m (60 ft) height. Three additional UNR-ROHN 43-m (140-ft) towers were installed by NREL crews at SCI sites Met2: 32°59.236' N by 118°33.209' W (at the present 675-kW wind turbine site), Met3: 32°58.630' N by 118°33.977' W (approximately 1 mile south of Met2), and Met4: 33°01.248' N by 118°33.041' W (Lemon Tank Reservoir). We

examined the Met2 data in detail and reviewed historical summary data to describe long-term wind characteristics.

The new data were collected through a full wind energy meteorological sensor system, including two anemometers, two wind vanes, a temperature probe, and a barometric pressure sensor. The anemometers were mounted 24.4 m (80 ft) and 42.7 m (140 ft) high at the new wind energy site on tower Met2.

Data collection began in August 1995 and continued through January 1999. All data were sampled at 1 Hz and then stored as 10-minute and 24-hour averages. The 10-minute average data were used for this report. Annual records of the 10-minute average wind speed and the monthly records use daily averages. An annual record is derived for air density using

$$\rho = p / (R \times T)$$

where ρ is density, p is pressure, T is temperature, and R = 0.286 kJ/(kg×K) for air. Then wind power density is derived using

$$P / A = 0.5 \times \rho \times V^3$$

where P is power, A is area, and V is wind speed. Using hourly average data, the diurnal wind speeds are created by computing an average for each hour of the day over all days in the period.

Wind direction data are difficult to present because the most common directions do not necessarily have the strongest winds. Therefore, this report includes three types of wind roses: percent time at each direction, average wind speed at each direction, and time-weighted average wind speed at each direction.

3.2 Historical Wind Data

This section begins with a review of 19 years of wind speed data (1960-1978) at SCI station number 93117, compiled by Pacific Northwest Laboratories and archived by the National Climatic Data Center [3]. Historical annual average wind speeds follow in Figure 10.

The airfield began its operations in 1960 and the historical 19-year anemometer locations changed several times for this collection of historical wind data, using different sensors, mountings, heights, exposures, and possibly drifting calibrations. Readings on the historical data were made 24 times a day after the first 3 years; readings before that were read 5 to 11 times a day. The heights varied from 5.2 m to 7.9 m; therefore each year's data were adjusted to the wind turbine hub height of 30.0 m (98.4 ft) using the 1/7 power law. These low measurement heights are very susceptible to the effects of obstructions.

The average historical 19-year wind speed at SCI, adjusted to the 30.0-m (98.4-ft) height, is 4.0 m/s (7.8 knots) based on annual averages of hourly data, and the average of the annual standard deviations is 2.6 m/s (5.1 knots). The standard deviation of the annual averages is 0.7 m/s (1.3 knots), giving a variability of 0.7/4.0 = 0.175, or 17.5%. Although confidence in the average wind speed is low, this variability implies that the annual average wind speed will fall within +/- 53% (3 standard deviations) 99% of the time, assuming these values are normally distributed.

Bias toward lower wind speed measurements on these older data sets is expected because of low heights, proximity to buildings and other obstructions, and possible binding of older anemometers. The airfield's altitude is 55.5 m (182 ft). The ASR-8 Radar hill with an east-west ridge peaking at 160 m (524 ft) south of the airfield is approximately 2,300 m (7,500 ft) away. Although the ridge does not shadow the prevailing north to northwest winds, it can deflect them upward and cause lower measurements below. Winds from the northeast to southwest are sheltered. Because these factors are not tractable, no attempt is made to adjust the data to account for them.

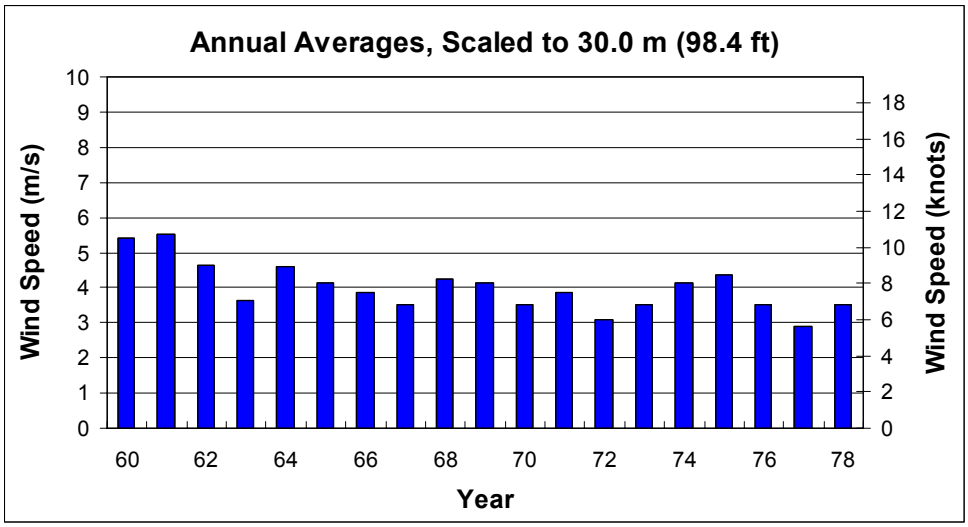


Figure 10. SCI historical wind speeds.

3.3 Current Wind Data

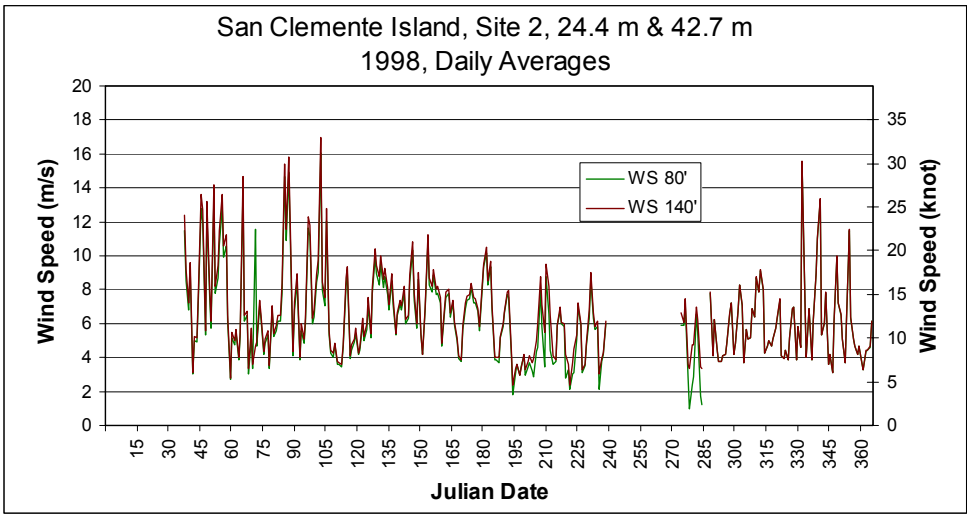
Data were collected between August 1995 and July 2000 at the 43.6-m (140-ft) meteorological Tower #2 at the designated SCI wind turbine site. The wind speed data were collected at 43.6-m (140-ft) height and temperature and pressure at 3 m (10 ft). The data collection rate was 100% in 1999, with eight lines missing out of 52,560. In addition, the data show error rates of less than 1%.

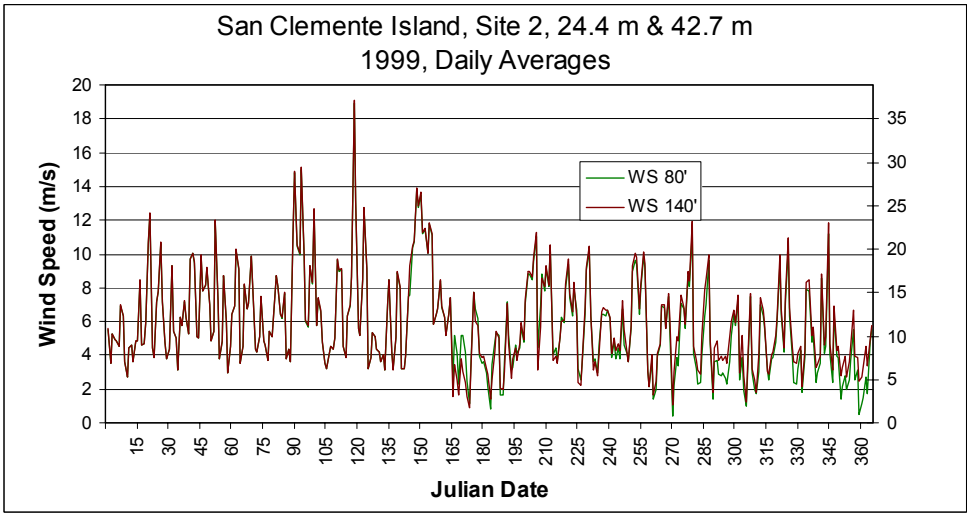
Wind speed records for both the 43.6-m (140-ft) and 24.4-m (80-ft) anemometers for 1998, 1999, and January through July of 2000 are shown in Figure 11. As the data were collected in late 1999, it became obvious that there was a divergence in the readings from the two sensors. This is where the two data lines begin to separate. However, it would be easy to miss the divergence in this format. Figure 12 shows the delta between those sensors for all of 1999, plotted in a natural log relationship. The 0.085 value is the natural log of the calibration offsets for both sensors. In this format, the divergence becomes very apparent. From Julian Date 1 through approximately 165 the steady, slightly positive line shows the sensors are reading consistently with each other, with the 43.6-m (140-ft) sensor reading a slightly higher value than the 24.4-m (80-ft) sensor, which is to be expected. After Julian day 165, the line becomes erratic, with the size of the difference becoming increasingly positive. This was interpreted as a failure of 24.4-m (80-ft) sensor, probably due to the salt-air environment wearing through the seal and entering the sensor bearings.

The anemometers were replaced on May 23, 2000. Figure 13 compares the calibration curves for the two sensors in their original condition and after they were removed from the site. Notice that the curves for the 43.6-m (140-ft) sensor are very close to each other and both are represented by linear curves. This shows normal, expected wear. However, the curves for the 24.4-m (80-ft) sensor are very different from each other, with a lower, exponential curve after removal. The upward divergence shows excessive friction in the slow speed range.

Because of this sensor failure, we will use only the 43.6-m (140-ft) sensor readings in the calculations in this report. After this experience we recommend replacing the anemometers annually.

Statistical analysis of the last five years of daily meteorological data yielded the results shown in Table 2, and a full wind speed distribution is presented in Figure 14. The 10-minute data set was not used here because of the amount of manual processing required to remove bad data segments. However, the 10-minute data would indicate somewhat higher standard deviations of 3.3 m/s and lower minima of 0.0 m/s (both affected by bad data), with maxima reaching 25.9 m/s.





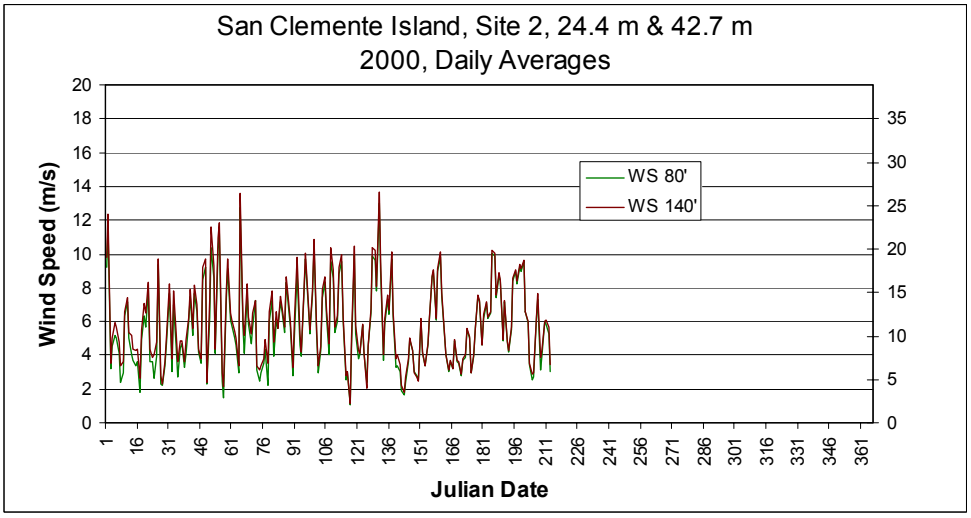


Figure 11. SCI daily averaged wind speed.

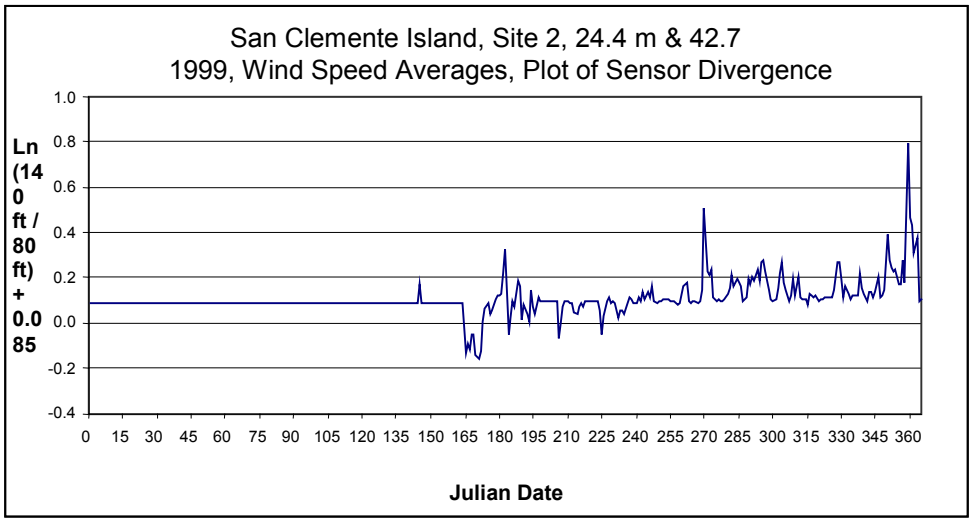
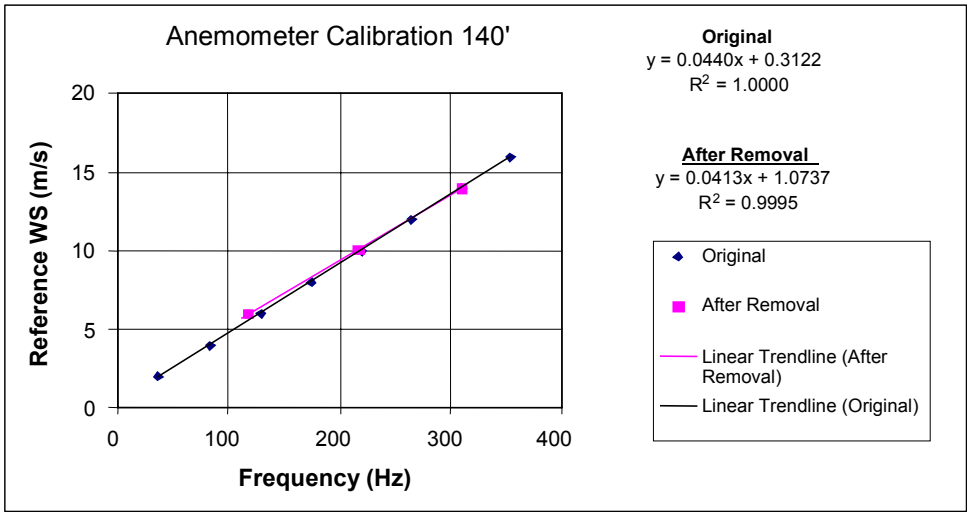


Figure 12. Delta wind speed between 42.7 m and 24.4 m.



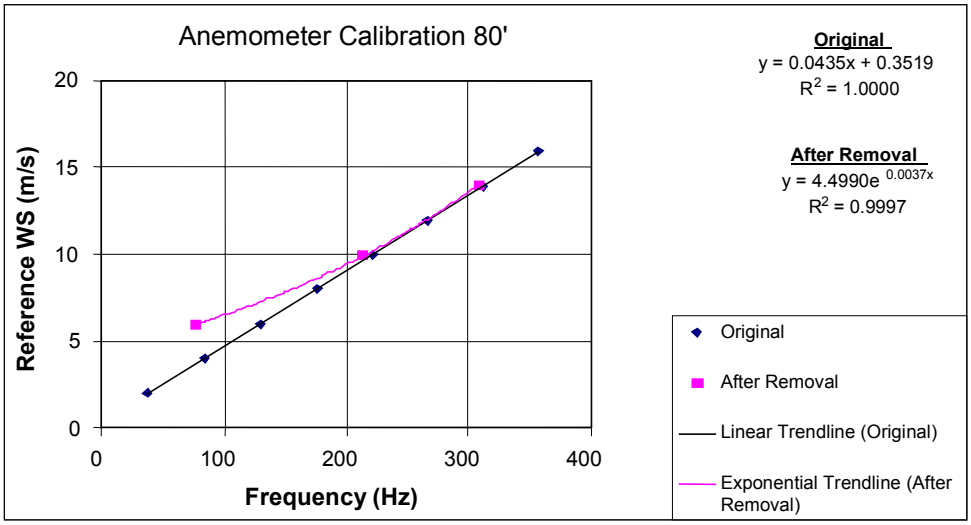


Figure 13. Anemometer calibrations.

Table 2. Summary of Current SCI Meteorological Data

Channel	Units	Average	Standard Deviation	Minimum	Maximum
Wind Speed, 1996	m/s	6.1	2.7	1.8	16.9
Wind Speed, 1997	m/s	5.5	2.6	1.4	18.0
Wind Speed, 1998	m/s	6.6	2.7	2.3	17.0
Wind Speed, 1999	m/s	6.0	2.8	0.9	19.1
Wind Speed, 2000 *(Jan 1 – Jul 31)*	m/s	6.0	2.5	1.1	13.6
Wind Speed, 1999	knots	11.6	5.4	1.8	37.1
Ambient Temp, 1999	°C	14.0	2.9	8.9	26.5
Ambient Pressure, 1999	mbar	987	26	806	1001
Air Density, 1999	kg/m^3	1.20	0.03	0.98	1.24
Power Density, 1999	W/m^2	223	359	1	4224

Note: Statistics based on daily averages.

Annual records using monthly averages have been plotted for wind speed, ambient temperature, ambient pressure, air density, and power density in Figures 15–19. The source data were derived from NREL testing on SCI at 42.7 m (140 ft) on tower Met2 for August 1995 through July 2000. Wind speeds are fairly consistent at this site; no months are significantly higher or lower during the years examined. The wind speed range generally falls between 5 and 9 m/s. Temperature and pressure cycle gently with more warmth and lower pressure in the summer, causing slightly lower summer densities. Power density looks like an exaggeration of wind speed, as expected from its cubic relationship.

The annual average diurnal given in Figure 20 shows a stable pattern, with wind speeds falling between 5.5 and 7.5 m/s. They are slightly lower through night and morning, and slightly higher through the afternoon and evening. The diurnal is derived from the 1999 hourly data set. Each hour is averaged through the whole year; any specific day could be quite different. For reference, the column labeled “0000” refers to the first hour of the day: 0000 to 0100.

The wind roses shown in Figures 21-25 also use the composite hourly data set. They indicate prevailing winds from the west and west by northwest, with somewhat stronger average wind speeds in these directions as well as in the northwest, southwest, and south.

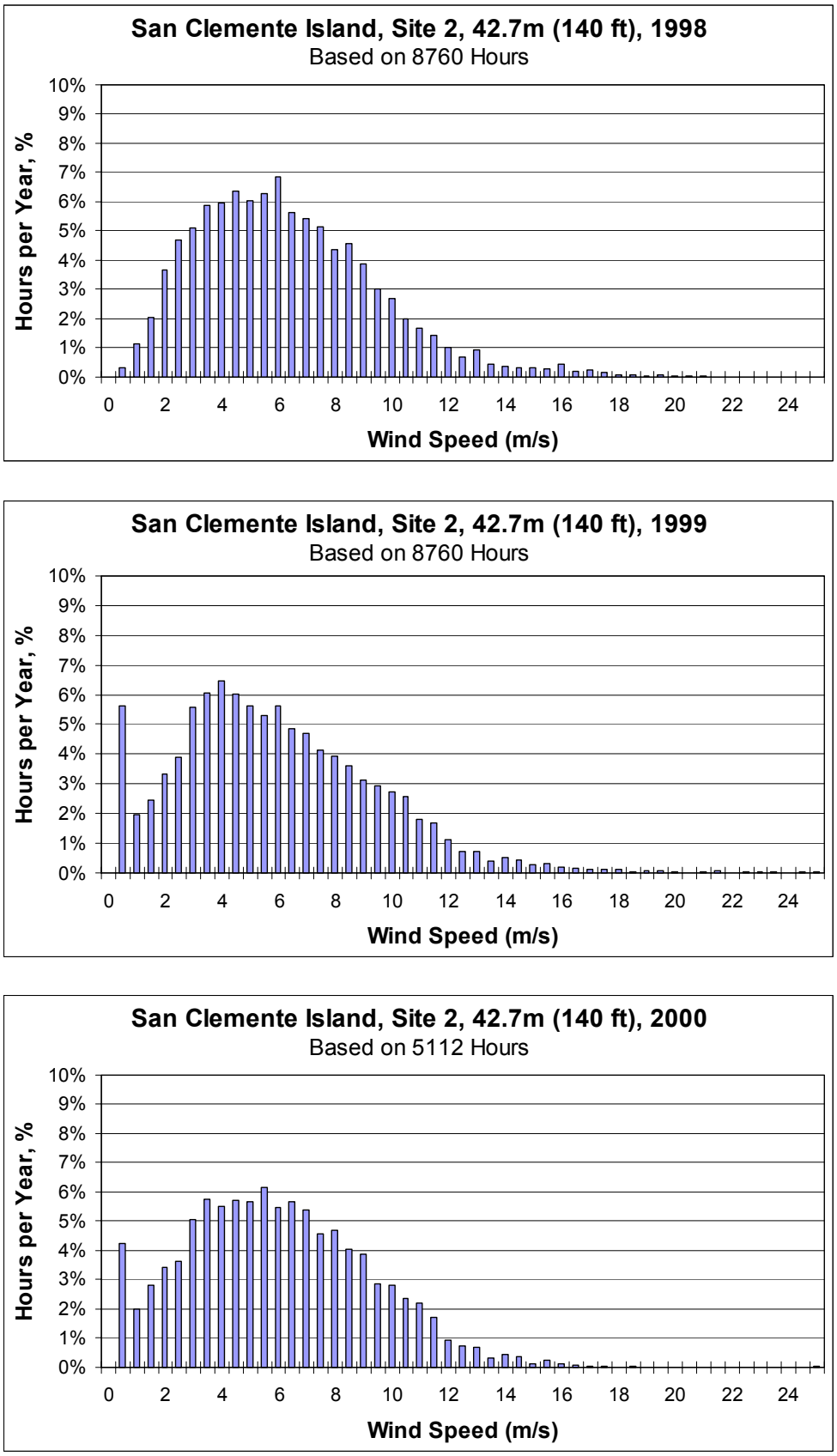
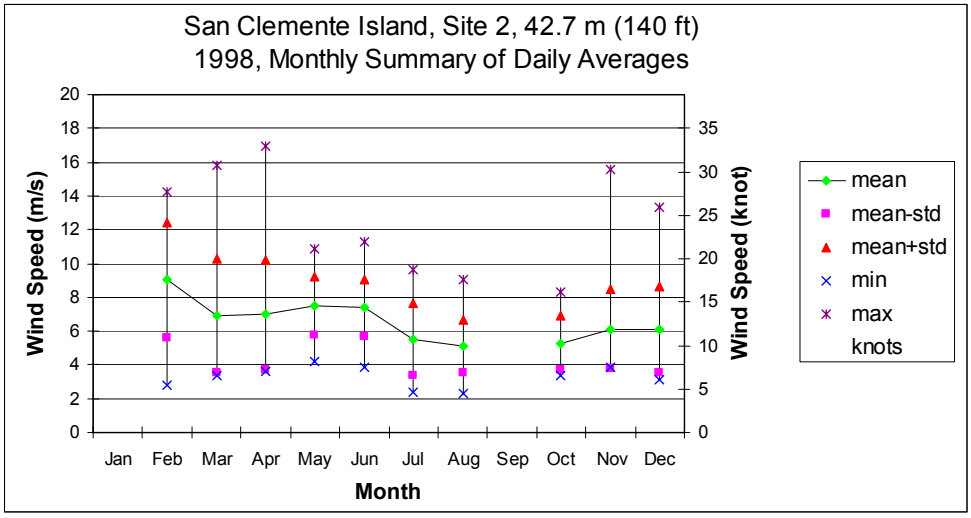
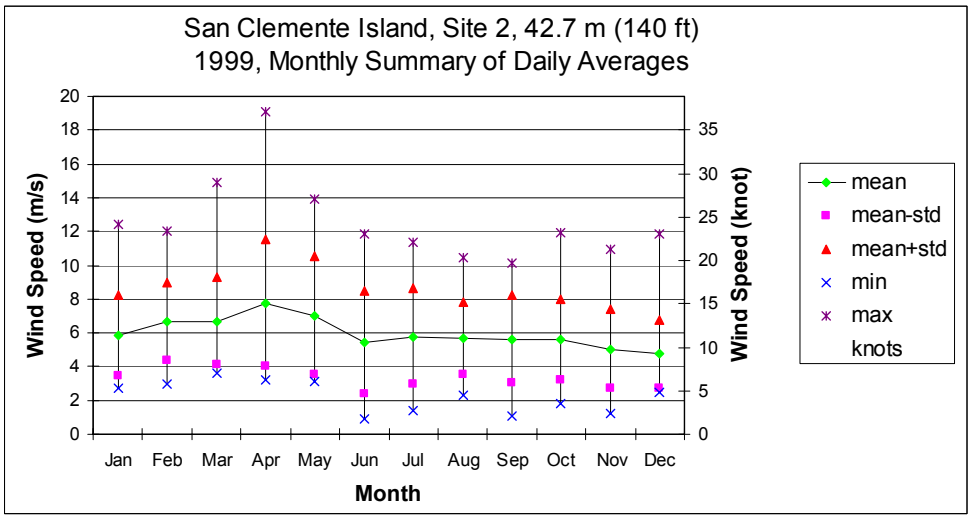


Figure 14. SCI wind speed frequency distributions, 1998 – 2000.





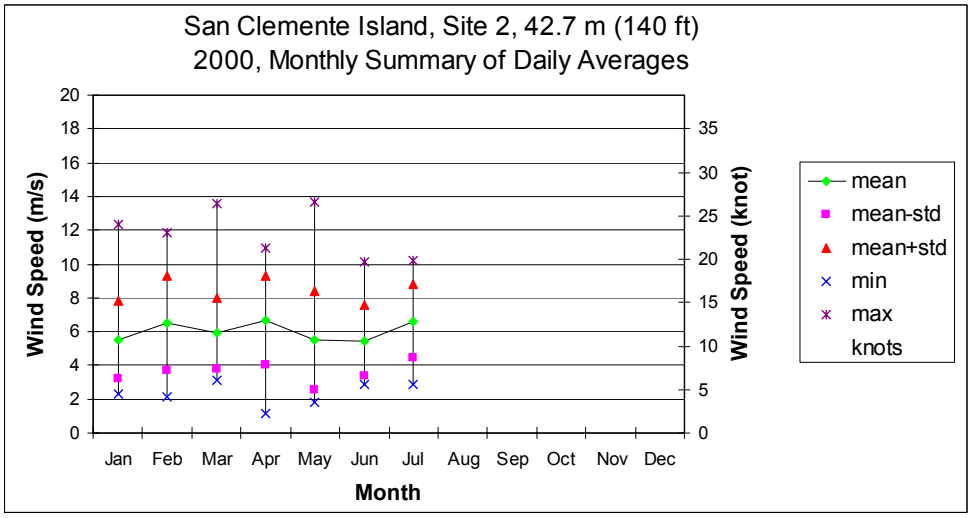


Figure 15. SCI monthly averaged wind speed.

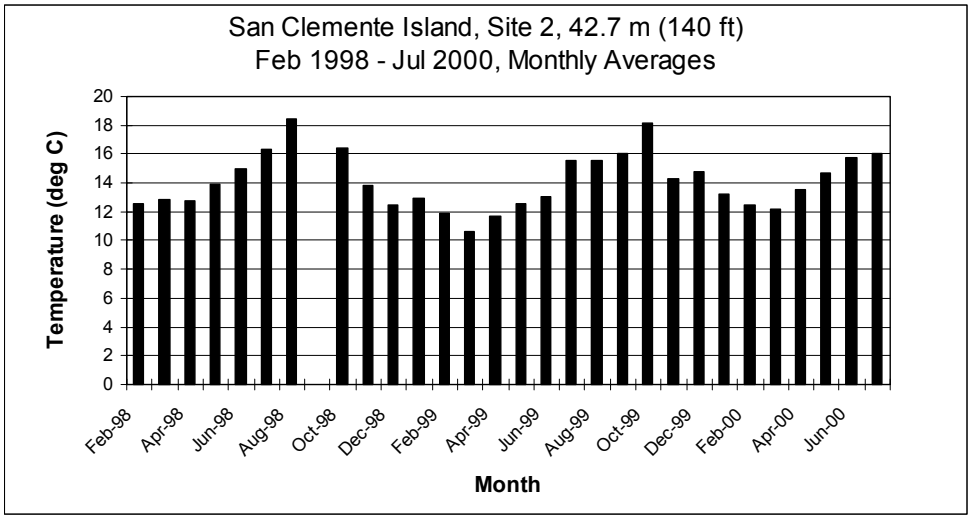


Figure 16. SCI monthly averaged temperature.

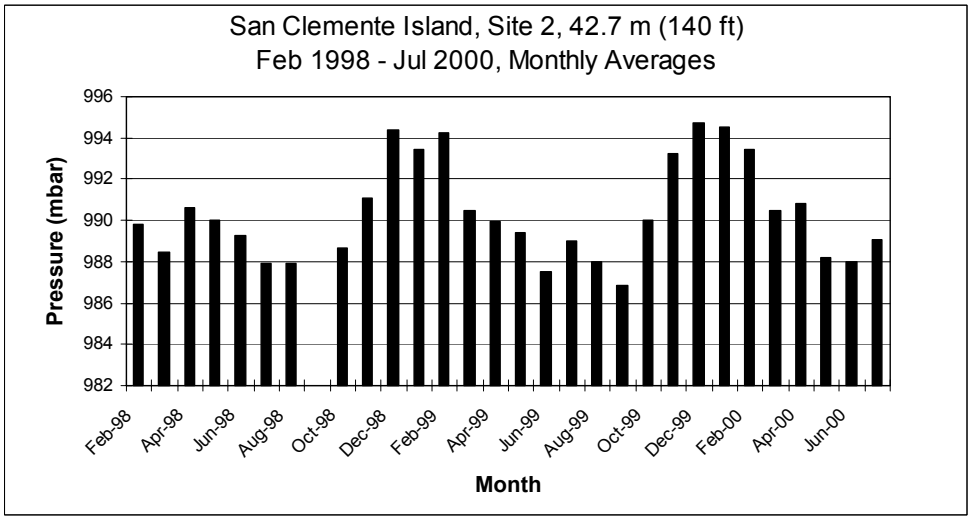


Figure 17. SCI monthly averaged pressure.

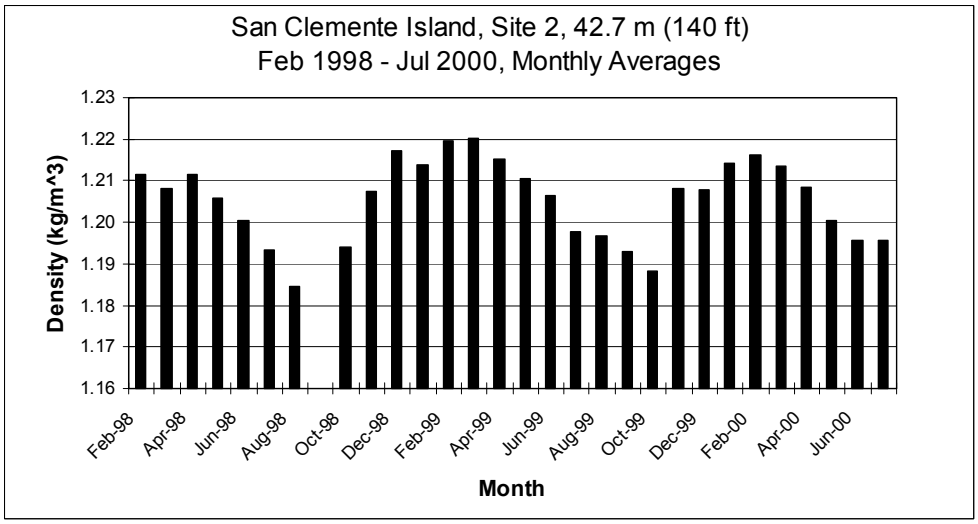


Figure 18. SCI monthly averaged density.

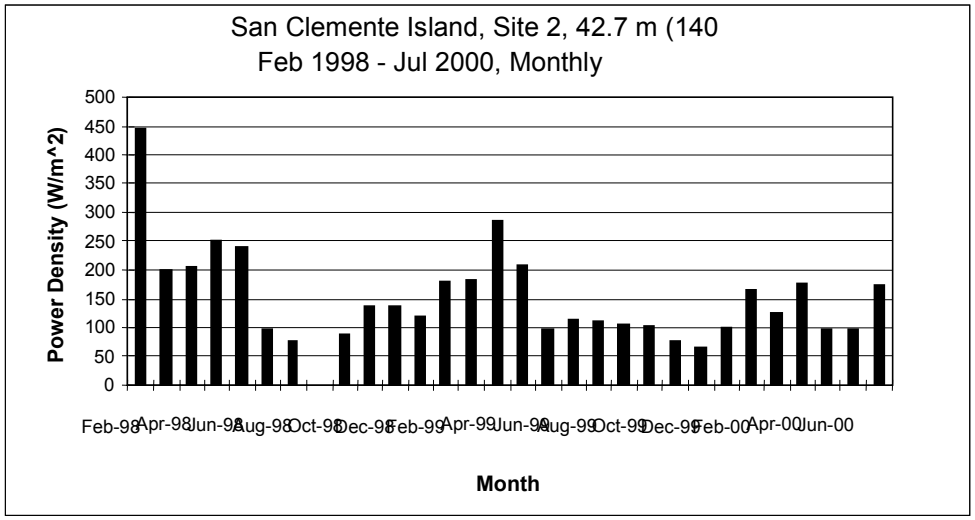


Figure 19. SCI monthly averaged wind power density.

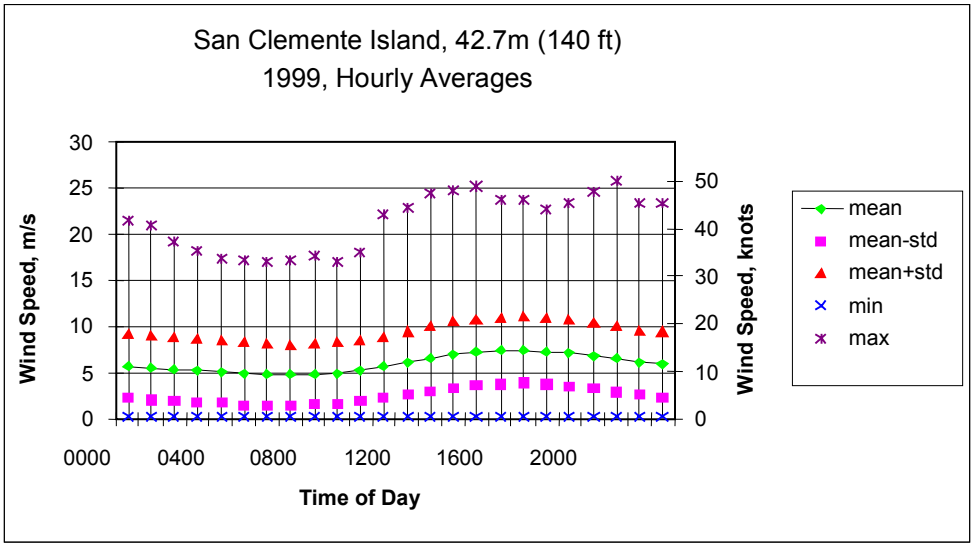


Figure 20. SCI annual average diurnal wind speed.

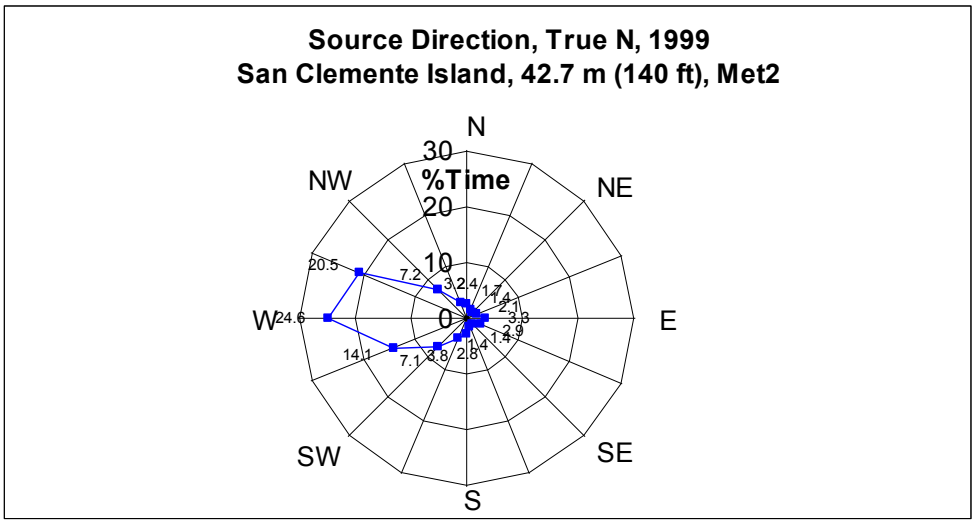


Figure 21. SCI wind rose: percent time.

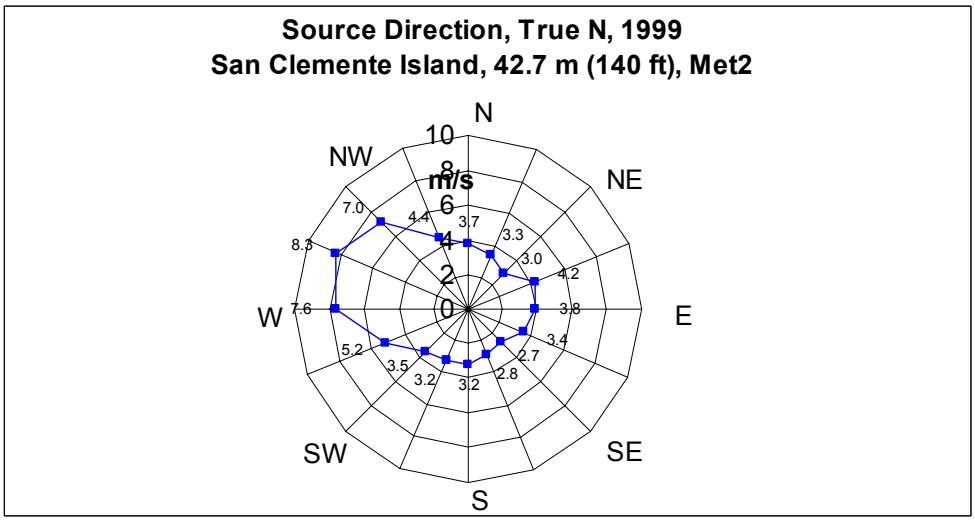


Figure 22. SCI wind rose: average wind speed (m/s).

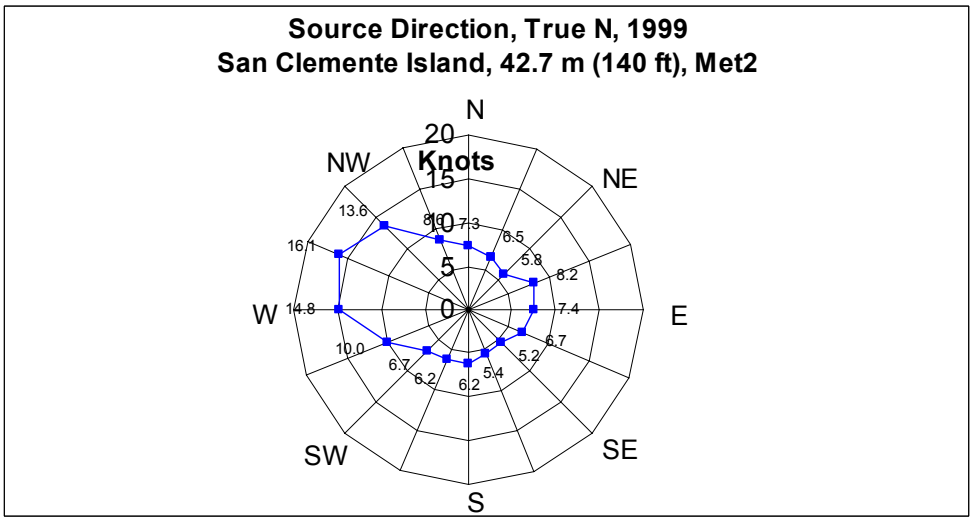


Figure 23. SCI wind rose: average wind speed (knots).

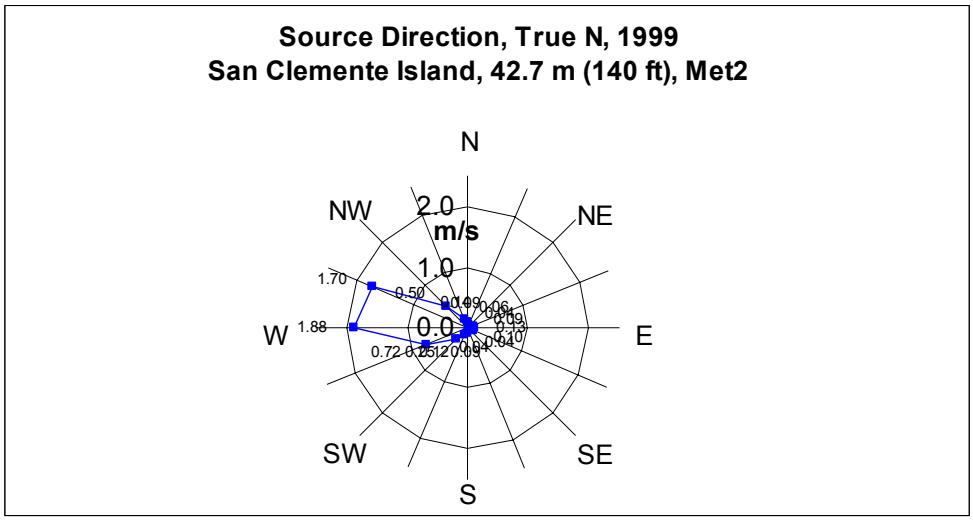


Figure 24. SCI wind rose: time-weighted average wind speed (m/s).

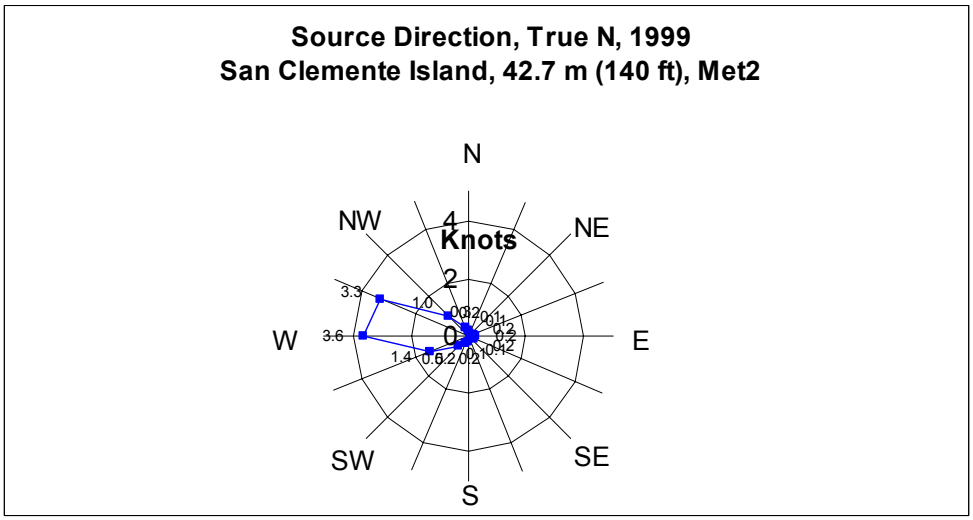


Figure 25. SCI wind rose: time-weighted average wind speed (knots).

4.0 Wind-Diesel Hybrid Energy System

The San Clemente Island hybrid energy system, consisting of combined wind and diesel generators is proving to be both economically and environmentally advantageous for the island and its operations.

The wind-diesel hybrid system is relatively simple. Three commercially-available wind turbines (total capacity of 675 kW) are combined with the existing 2950 kW diesel generation. With a demand peak of 1508 kW (most recent year 2000 data), no more than 1700 kW of diesel should be necessary at any time. Therefore, wind penetration of online capacity with three wind turbines is 675/1700 = 39.7% based on instantaneous power. Wind penetration based on energy provided, can range from 0% when there is no wind to 100% when available wind power (with a peak of 675 kW) exceeds the load (minimum of 388 kW noted).

The addition of wind turbines to an isolated grid introduces new operational requirements. Although numerous operational strategies are possible, the initial approach consists of the original set of rules for diesel operation plus several new rules. The diesel operation rules primarily seek to maintain sufficient spinning reserve to handle both planned and unplanned load transients. Although adding wind turbines can remove substantial load from the diesels, some other rules of operation come into play.

At least 100 kW must be generated by the existing diesel generators to prevent diesel idling and maintain a working load, even when there is excess wind capacity. Long periods of diesel idling cause a buildup of carbon. Only the necessary number of wind turbines should generate power at any given time, with the remaining turbines idled. Second, the available diesel capacity must be able to provide the reactive power requirement for the load, because the wind turbines provide only real power. This requirement will be discussed further in section 4.5 and Appendix B.

4.1 Diesel Energy System

The existing SCI power plant is located in a sheltered cove about 3.2 km (2 mi) from the hill where the wind turbines are located (see Figure 26). Power for the island grid is generated by diesel at 4,160 V and stepped up through two 2,000 KVA transformers to 12,470 VAC, three-phase, three-wire (Delta) for distribution on the island.

The San Clemente Island power demand for 1999–2000 ranges from a minimum of 388 kW to a maximum of 1508 kW. The fuel needed (with no wind energy input) is calculated based on minimizing the number and rating of operating diesel generators. Configuring the diesels to produce 500, 750, 1200, or 1700 kW can meet the power demand.

The power plant and island power grid, have the following electrical characteristics:

Grid Voltage:	12.47 kV
Frequency:	60 Hz +/-1.0 Hz
Power Factor:	0.8–0.95 lagging
Average Load:	902 kW (SCI_2000 Data)
Maximum Peak Load:	1508 kW (3/9/2000 @ 1123 hrs)
Minimum Load:	502 kW (SCI_2000 Data)

Diesel Generator Sets: Electrical power at SCI is presently supplied by four Navy-owned, 3-phase, 4160-V, diesel-driven electric generators that are operated by the Public Works Center located in San Diego (see Figure 27). The diesel plant on the island was rebuilt in 1994 as Building 60137.

The Navy rates two of the diesel generator sets at 500 kW, one at 750 kW, and one at 1200 kW. Typically, only one diesel is run at a time, unless the island's electrical demands require more than 1000 kW. Then two diesels are generally on line to provide the electrical capacity required.

The San Clemente Island operating data for the 20 months of January 1999 through July 2000 show an average diesel fuel consumption rate of 257 liters per hour (l/h) (68.0 gallons per hour [gph]), and average energy conversion rate of 3.05 kWh/l (11.5 kWh/gallon, from Table 1). The engines' specific diesel fuel rates are shown in Table 3.

Table 3. Diesel/Generator Power Rating and Fuel Consumption

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)

Unfortunately, there are little real data for the units operating at no load. The only information available is from EMD Power Products for its similar 12-cylinder, turbo-charged units during EMD factory testing. On units similar to 12-645E4, they recorded 57 liters per hour (15 gal per hour) at rated speed, no load. Based on this information, the hybrid system analysis presented later in this report uses a no-load consumption value of 17% of full load consumption. For the other units, the literature [4] would suggest an approximate value of 25% of full load.

The diesel generators follow the load automatically through speed and frequency monitoring. The diesels have no specific selection priority, but there are other constraints. At least one diesel must be on line at all times to ensure reliable capacity and system stability; the present minimum operating load for the diesels are set at 100 kW, or 20% rated power for the smallest unit. In addition, a margin of 300 kW (diesel rating minus

average load) is preferred to allow for transients, even though users are advised to call before energizing large loads.

According to past SCI power system operating records from 1996 to present, the manual operating scheme tended to favor running the large engine for long periods of time, as estimated from the Navy-supplied data. That scheme maintains a high margin and reduces the number of engine starts, at the expense of lower fuel efficiency. The resulting excess margin causes the diesels to run substantially below their ratings. An optimized operating scheme alone could provide some fuel savings, but it would require many more diesel starts and operations labor or an auto-start system.

In the current operating protocol, online diesel capacity typically exceeds average demand by a substantial margin. This ensures enough capacity is available to cover excursions and to avoid too-frequent switching between diesels and lower energy conversion efficiencies. A tighter margin would allow more efficient operation but the more frequent switching would cause faster wear on the diesels and more work for the operators.

Figure 26. View of SCI diesel power plant. ***Source: NREL Photograph***

Figure 27. View of SCI diesel plant operations. ***Source: NREL Photograph***

Fuel Supply System: Petroleum products are delivered to SCI by a regularly-scheduled barge and unloaded at Wilson Cove. Diesel fuel is delivered by barge to the fuel tank farm at the north end of Wilson Cove. Barges dispensing fuel pump fuel directly into aboveground storage tanks. The DL-2 fuel is stored in the 37,854-liter (10,000-gal) aboveground tank located to the north of the power plant, Building 60137. Fuel is continuously circulated and centrifuged in this tank. Upon demand, fuel is automatically diverted from returning to the main storage tank and sent to day tanks located just outside the power plant instead. From the day tanks (one for each engine), fuel flows by gravity to each operating engine's fuel pump.

A 757-liter (200-gal) lubrication oil tank is located within Building 60137. Oil is added to each running engine via pumps or centrifuge. Each engine has a direct pipe connection to the lube oil centrifuge, and oil can be gravity-fed at this point or pumped in.

The plant is also provided with a waste-oil collection system. This system consists of one 1514-liter (400-gal) holding tank. The tank and pumps are located immediately outside

the power plant and are equipped with secondary containment and interconnecting piping.

Balance of Plant: The plant is operated 24 hours per day. Operators observe equipment operation, make hourly log entries, and start and stop the generators as required. The control room has been recently upgraded and is enclosed by sound-reducing insulation and double doors leading to the engine room.

The station auxiliary equipment includes two 150-kVA, three-phase, 4160-120/208-V station service transformers; a 120/208-V distribution panel board; a 20-battery 125-VDC station battery bank; and two 2,000-kVA, three-phase, grounded-wye-delta-connected grounding transformers. There is one grounding transformer for each bus in the switch-gear to provide a neutral for single-phase, 2400-V loads.

The power plant switch gear, installed in 1994, has two buses with a vacuum circuit-breaker tie. The circuit-breaker tie will trip automatically in the event of a fault on either bus.

In addition to the 4160-V generators, local emergency generators provide backup power for critical loads. The power is generated at utilization voltage (120/208 V or 480 V) and is applied to the load through manual or automatic transfer switches.

Distribution: Electricity is distributed throughout the island by three 12.4-kVA, 4160-V feeders. Feeder #D-Line serves most of the southern end of the island, as well as the three wind turbines. Feeder #C-Line serves the north-central area of the island, including personnel living facilities, administration and recreational facilities, and the public works buildings. Feeder #A-Line serves the air terminal and associated hangars and maintenance facilities, and loads in the northwest part of the island.

The SCI Air Field portion of the distribution (feeder #A-Line from pad A-57-7) is completely underground. Feeders #C-Line and #D-Line use mostly overhead lines, consisting of wood poles supporting bare copper conductors.

4.2 Wind Energy System

The wind turbine electrical power generation facility is composed of three NEG Micon model 225/30 wind turbines (see Figure 28). Each individual wind turbine has a rotor area of approximately 700 square meters and a rated output of 225 kW. The wind turbines start producing power at approximately 4 m/s (9 mph) and continue producing power up to 25 m/s (56 mph). The wind turbine locations are given in Table 4.

Figure 28. SCI DOE/FEMP and SERDP-funded wind turbines. ***Source: NREL Photograph***

Table 4. SCI Wind turbine Locations

Turbine #	Latitude	Longitude	Elevation
1	32°59.140' N	118°33.099' W	223 m (713 ft)
2	32°59.172' N	118°33.125' W	223 m (729 ft)
3	32°59.245' N	118°33.164' W	223 m (717 ft)

The sea-level power curve for this turbine model is shown in Figure . A fifth-order polynomial was fit to the curve for use in the spreadsheet model. No density correction was made to the power curve, as the present SCI wind site is only 700 ft to 750 ft above sea level. The wind turbines can be curtailed (shut down) as necessary when excess wind energy is available.

Wind Distribution: The energy in the wind is proportional to the wind speed cubed, and the wind turbine can only extract a portion of that, generally between 20% and 50%, based on the theoretical Betz limit (59%) less various system and operational losses. Also, the wind speed at hub height often will be somewhat less than the wind speed at the measurement height, because of wind shear, a variation in which wind speed increases with height above the ground. The average wind speed for 1999 was 6.0 m/s at 42.7 m (140 ft), with a wind shear of 0.10 measured in 1998. At 30-m (98.4-ft) hub height, that translates into an average wind speed of 5.8 m/s = [6.0×(100/140)^0.10].

Energy Production: The net annual energy production (AEP) can be computed by multiplying the power production level by the number of hours for each wind speed level and summing the results. If P_i is power and N_i is number of hours at each wind speed, then:

$$AEP = \text{sum}\ (P_i \times N_i), \quad i = 0.0, 0.5, 1.0, \ \ldots\ 100.0 \text{ m/s}.$$

The actual AEP is often lower because of various system losses. Assessment of the wind site showed that there are no significant obstructions to the prevailing wind flow. Also, there is room for additional wind turbines without interference, so array losses should be mitigated with proper siting. Other sources of loss could include 1%-5% availability loss for operation and maintenance, up to 5% for blade soiling losses, up to 2% for turbulence losses, and up to 3% for control, grid, and collection system losses. Using 97% availability, the combination of these sources is significant, having a possible net loss of 11.5%. However, the first three years of operation for the three SCI wind turbines has generated power curves that match the manufacturer's published curve and demonstrate 99% availability.

Each wind turbine consists of a number of specific components as described below.

Nacelle: The base frame is designed as a self-supporting, integrated, welded steel plate construction which also supports the main shaft bearing, gearbox, generator, yaw system, rotor, etc. The integrated construction is hot dip galvanized and makes up the bottom half of the nacelle cover. The upper half is made from lighter, hot dip galvanized steel plate.

Yaw System: The yaw system applies forced yaw by electrical gear drive over a cogged ball-bearing ring with friction brake system.

Rotor: The rotor consists of three blades manufactured by LM Glasfiber (LM) Aeroconstruct, type LM 13.4, fastened to a hub. The blade diameter is 29.6 m (97.1 ft) with a swept area of 688 m^2 (7407 ft^2). The height to the blade tip in straight, upright vertical position is 44.8 m (147.0 ft).

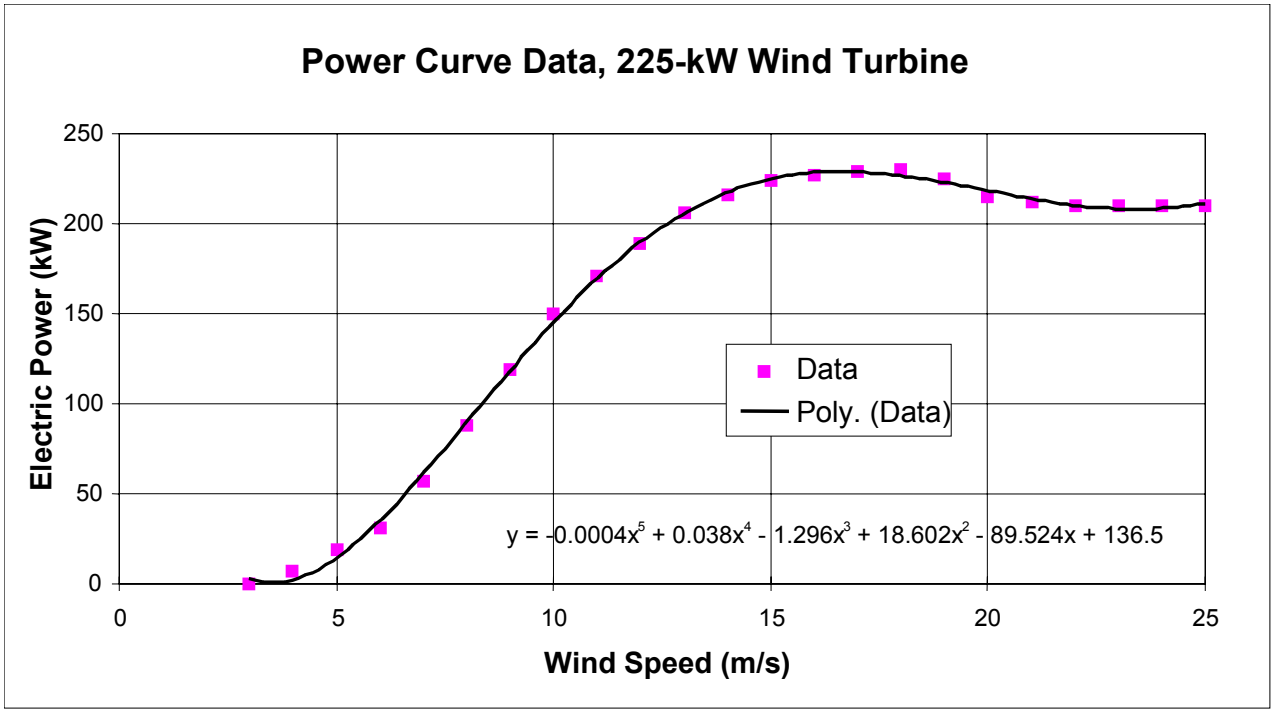


Figure 29. Power curve, NM 225-30 (225-kW) wind turbine.

Tower: The tower height is 28.7 m (94.2 ft), with a hub height at the center of the rotor of 30 m (98.4 ft). The tower weight is approximately 12,000 kg (26,455 lbm), and has three layers of zinc silicate for protection from the island's marine environment.

Wind Turbine Control: The local wind turbine control panel is located inside the tower bottom, protected against weather and unauthorized access. Its function is to provide automatic cut-in of the generator to the SCI electrical grid, fault detection, and wind turbine protection. This control panel has easy access to operate and control the wind turbine. The wind turbine controller has displays with fault indicators to secure quick fault-finding in case of a turbine stop condition. If the SCI grid fails and is then brought back on line, the wind turbines can be automatically restarted. These wind turbine controllers are under the supervision of the main wind turbine control computer located at the SCI Public Works Center (PWC) diesel power plant.

Electrical: The wind turbine has an induction generator that follows the grid frequency and consumes reactive power. The MICON wind turbine is equipped with phase-compensation capacitors, which improve the power factor to 0.96 lagging. Over-voltage protection in case of lighting is provided in the control system. Soft startup is also provided by thyristors that limit the inrush current to 1.3 times normal current.

4.3 SCI Operational Results

Wind turbines #1 and #2 were not fully utilized February to March 1998, and turbine #3 was not fully utilized July to October 1999. This was because of initial startup and adjustment activities and subsequent grid problems and construction activities. Once fully commissioned, the wind turbines have demonstrated over 99% availability and perhaps one or two days per year with no production because of lack of wind. Other downtimes occur occasionally during SCI utility maintenance, repair, or grid upgrades.

The SCI electrical power system saved a substantial amount of fuel with the energy contribution of the wind turbines. In 1998, wind turbine production of 785,938 kWh yielded fuel savings of approximately 66,100 gallons; in 1999: 910,204 kWh and 77,600 gallons; and in 2000 (as of July 31, 2000): 766,974 kWh and 61,600 gallons. By number of turbines, the diesel fuel savings were as follows: 11.2% with the first two 225-kW wind turbines between February 1998 and October 1999, and 15.4% with three wind turbines between November 1999 and July 31, 2000. Additional detail is provided in the monthly power plant production logs in Appendix D. Meanwhile, the loads at SCI grew approximately 10% per year. The load growth leveled off in 2000, but new construction evidence implies substantial continued growth in the coming years.

A standard concern of the SCI utility is maintaining sufficient diesel operating margin to handle load transients. The change in demand from one hour to the next using the derived SCI hourly demand data has an average of 34 kW and a peak of 374 kW. These fluctuations coincide with operating experience, which has demonstrated about 50 kW normal fluctuation and an occasional 100-kW to 300-kW demand step or spike. Statistically, short-term load variability is 0.153, based on the 1999 average load of 910 kW and one standard deviation of 139 kW. This brackets the operating experience with three standard deviations of 417 kW.

Annual diurnal wind speed and load are overlaid in Figure 30. Both the diurnal load and wind speed are relatively steady, with the diurnal wind speed cycling between 4.8 m/s and 7.5 m/s, giving a somewhat neutral correlation. Table 5 expands on Table 2 to show the impact of the wind turbines on system operations.

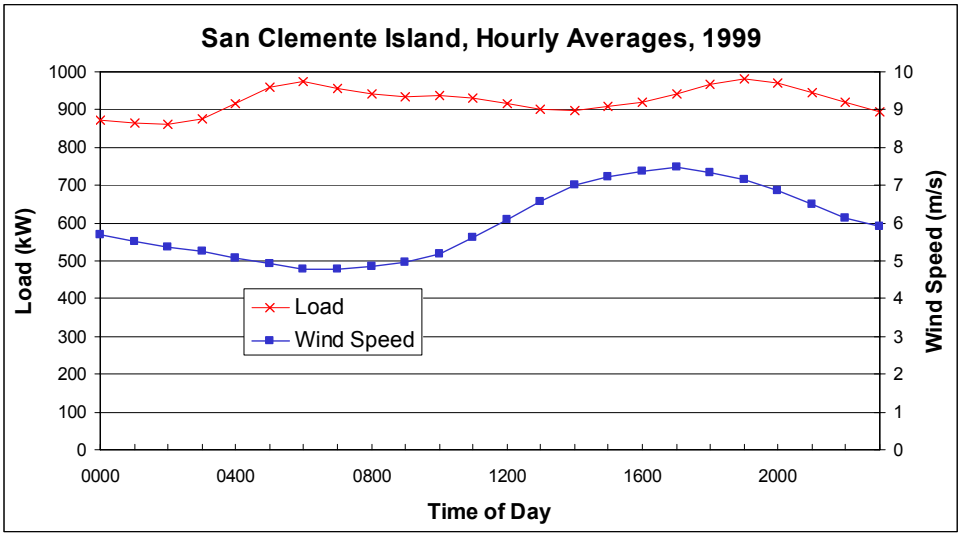


Figure 30. SCI diurnal load and wind speed overlay.

Table 5. Wind Energy Impact on Total System

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 (1)	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 Capacity Factor % (2)	n/a	22.1	21.3	21.4
Fuel Usage	kltr	2074	2278	1322
Fuel Saving	kltr	273	294	254
Fuel Saving	% of total	11.6	11.4	16.1

Notes:
(1) "Net Diesel Load" means net power required from the diesels, or system load minus useable wind power.
(2) Wind System Capacity Factor = Wind Energy [MWh/year] / (#turbines×rating[0.225MW]×hours/year).

4.4 Power Quality and System Stability

Care is maintained to ensure that proper system voltage and frequency are maintained, as the quality of the SCI-generated electrical power must be such that no military or civilian component system (example: radar and communications systems) would experience deteriorated function during its operation. The quality of power is expressed in terms of the physical characteristics and properties of the electricity generated. The SCI power plant provides its military and civilian customers with high power quality, providing constant sinusoidal voltage, constant voltage amplitudes, and frequency stability. A report specific to these issues will be released to the Navy before the end of 2000.

The mode of operation employed at the SCI Utilities power plant maximizes stability of the hybrid power distribution system by providing continuous diesel operation when the wind turbines are on line. A computerized 250-kW dump load is activated when required to ensure that the diesel engine load never drops below 100 kW.

One risk with adding wind energy to an isolated grid is that it can introduce larger power fluctuations than typical system loads and can stress the load-following capability of the diesels. However, both the diesels at SCI and simulation [5] results (Appendix C) have demonstrated no difficulty following both load and wind power fluctuations. The only problem observed with the addition of a third wind turbine is an occasional dip in power factor, which will be discussed below.

Voltage stability: Power quality measurements taken by Pacific Industrial Electric staff in both in 1998 and 2000 and by Naval PWC San Diego in 1999 have shown voltage level control by the wind turbines to be well within permissible ranges of operation. Rapid voltage fluctuations noted in the 1999 test appear to coincide with the weekly barge heavy-pumping operation using a large inductive motor. These fluctuations may be attributed to a defective slow-start controller.

Frequency stability: SCI power plant diesel operations provide the frequency stability. The diesel generation system usually maintains between +/-1 Hz stability. Large demand loads have the ability to drop the frequency 4 Hz or more. Extremely large unexpected loads have the potential to drop out a diesel, thus causing a power outage.

The wind turbine systems, being inductive generators, only have the ability to follow whatever frequency is dictated by the diesel generation system. The wind turbines have been set to shut down when the frequency exceeds +/-2 Hz; they can be set as wide as +/- 4 Hz. The wind turbines can assist in holding the grid field briefly during an emergency diesel generator switch and thus assist the operator in bringing another generator on line.

Harmonic content: No harmonic content problems have been observed to date. It is possible for semiconductor-controlled rectifier (SCR) controller switching within the wind turbine system to generate small 2nd to 5th harmonics if problems occur within the

controller system. This would be the same problem encountered by any static inverter, converter, or other electrical device that had the same electronic components.

Phase balance: The voltage imbalance of the SCI 4160-V three-phase system can be defined by the ration of the negative-phase-sequence component to the positive-phase-sequence component. The wind turbine system has not shown any irregularity on phase imbalance to the SCI grid network.

Power factor: Because the wind turbines have their own power factor correction capacitors, the D-line at the wind turbines has exhibited proper power factor at all production levels on both the 40-kW and 225-kW generator windings. However, a low power factor sometimes appears at the power plant when the wind turbines produce a substantial proportion of the load (see Appendix E). Although one of the small diesel generators can provide the remaining real power demand, it sometimes cannot provide enough reactive power for induction loads on the system. This situation then requires a larger diesel, but at an inefficient and low real power level. San Clemente Island Utilities plans to install power factor correction at the power plant to resolve this problem.

5.0 Environmental Issues

5.1 Diesel Emissions

For air quality, SCI falls under the jurisdiction of the South Coast Air Quality Management District (SCAQMD). The Naval Public Works Center environmental division requested and was granted an exemption for SCI from the RECLAIM Program in 1995 and SCAQMD Rule 1110.2 in 1996.

The formulae used to compute estimated emissions reductions for #2 diesel fuel (DL-2) were obtained from San Diego Air Pollution Control District (SDAPCD). Although not specific to each individual diesel generator at SCI, these are representative data for stationary diesel combustion. DL-2 has a heat rate of 137,000 Btu/gal. The emission factors shown in Table 6 are based on pounds per million BTU of diesel fuel input.

Table 6. Diesel Fuel Emission Factors

Pollutant	Emissions Factor (lb/MMBtu)
NO_2	4.41
CO	0.95
SO_4	0.29
$PM\text{-}10_6$	0.31
CO_2	164
Aldehydes	0.07
TOC	0.36

Fuel: Source Classification Code (SCC) 2-02-001-02, 2-03-001-01

Directives from the Secretary of Energy's Executive Order 13123 for Greening the Government Through Efficient Energy Management, dated June 3, 1999included the following:

- Each agency shall reduce greenhouse gas emissions attributed to facility energy use by 30 percent in 2010 compared to such emission levels in 1990. (Sec 201)
- Each agency shall reduce energy consumption per gross square foot of its facilities, excluding facilities covered in section 203 of this order, by 30% by 2005 and 35% by 2010 relative to 1985. (Sec 202)
- Where appropriate, agencies shall consider the life-cycle costs of combinations of projects, particularly to encourage bundling of energy-efficiency projects with renewable energy projects. (Sec 401)

5.2 Emissions Savings

Annual emissions savings from wind turbine operation at SCI between Feb 1998 and July 2000 follow in Table 7. Notice seven months of 2000 emissions reductions already exceed the reductions from 1999, a result of adding the third wind turbine.

Table 7. SCI Emissions Savings

	Emissions Savings (lb)		(Jan-Jul)
Pollutant	1998	1999	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

Relative to SCAQMD and the RECLAIM program, NO_2 and SO_4 appear to be the main pollutants being traded. The costs on the pollutant information show SO_4 fluctuating between \$121 and \$146/ton between a two-month period. NO_2 varied between

approximately $650 and $1000 in the same time period. At the low end, these would translate into $15,424 for 1999.

6.0 Cost Analysis

6.1 Methodology

Using fiscal year 2000 operating costs for the wind-diesel hybrid system, the resulting levelized cost of energy (COE) and payback period were determined. COE is derived using

$$COE = NPV \times CRFI / AEP,$$

where NPV is the total net present value of all system costs, CRFI is the capital recovery factor for system income, and AEP is annual energy production (system load). A simple payback period is calculated by dividing the total initial capital cost by the annual savings from system operation, which includes the difference in fuel, overhaul, and operations and maintenance (O&M) costs between the wind-diesel hybrid and baseline systems [4].

Economic assumptions included 2% general inflation, 2% fuel inflation, 6.9% discount rate, 20-year system life, and 100% down payment on new investment. Although new wind turbines will start with a 20-year life, the existing diesel systems have been in service for several years and have limited lives of their own. This is covered by a fund for major diesel overhauls. It was further assumed that no additional labor would be required to operate the wind-diesel hybrid plant beyond that already assigned to operate the existing diesel power plant.

6.2 Diesel System Costs

A complete and accurate breakdown of SCI power system operating costs is not available from any single source, since several different offices handle various aspects of that operation. As part of PWC-SD, SCI Utilities purchases the diesel fuel while the Defense Energy Supply Center (DESC) handles delivery to the island. Also, while SCI Utilities performs plant operations and maintenance and major diesel generator overhauls, multiple departments within PWC-SD manage many of the associated purchases, accounting, and generates monthly and annual Utility Cost Analysis Reports (UCAR).

After considerable review of information from these various entities including actual costs to deliver (barge) fuel to SCI, the costs for diesel plant operation in fiscal year 2000 total $1,727,390. This is based on the following components:

Fuel price, delivered:	$772,983, using 2003 kl (529,078 gal) and $0.386/l, ($1.461/gal)
O&M, sans fuel:	$954,407, including distribution and wind energy.

The fiscal year 2000 gross plant production reported in the UCAR was 7512 MWh, 4% under the measured 7795 MWh. The measured portion of the energy from diesel was 6683 MWh; wind 1112 MWh. Dividing diesel energy into total annual operating costs gives $0.258/kWh. However the customers are billed $0.390/kWh. The gap of $0.132/kWh may appear unexplained, but further research revealed that the price of $0.390/kWh has been fixed since 1995, despite wide variations in actual operating costs over those years. Those costs were $0.473/kWh and $0.463/kWh, leading to operating deficits during major overhauls in 1995 and 1996, and they have declined gently to the current level of $0.258/kWh.

Without actually trying to detail the diesel life-cycle costs, the $0.390/kWh energy price appears reasonable. Subtracting the fuel energy cost of $0.116/kWh and the O&M energy cost of $0.143/kWh leaves $0.131/kWh for diesel overhauls and replacement, and perhaps for other undiscovered costs. One might assume O&M costs are half fixed and half variable relative to energy production, while overhaul costs vary with runtime, thus giving a fixed annual cost of (0.072×6,682,926) = $481,171, and variable rate of (0.071+0.131) = $0.202/kWh.

6.3 Wind Energy System Costs

Wind-diesel hybrid system costs include the baseline costs as given above, plus new costs associated with the wind turbines and interconnect and control equipment. The interconnect and control equipment are included with the wind turbine balance of station (BOS) costs, along with foundations, installation, spare parts inventory, site surveying and preparation, O&M facilities and equipment, permits and licenses, project management and engineering, and construction insurance and contingency. If multiple turbines were installed at one time, per-unit turbine price and BOS costs would drop, but we used the actual costs incurred for the economic analysis.

Each 225-kW wind turbine cost $220,000, plus $25,000 shipping from Denmark to Los Angeles then to SCI, for a total initial capital cost (ICC) of $245,000. An additional $440,510 was required for each wind turbine to cover BOS costs in 1998 [1], and $550,000 for the third turbine in 1999. Therefore, the total capital cost (ICC+BOS) required for the three NALF wind turbines installed at two separate timeframes was $2,166,020 or $722,007 per turbine. If all three turbines were installed together, the overall cost would have been about $1,900,000, or $633,333 per turbine. Overhaul costs are fixed at an annual $1000 per wind turbine, regardless of turbine usage. Actual wind turbine O&M costs of $0.005/kWh are doubled to $0.01/kWh to account for the small system size and the extra burden SCI represents with its remote setting. As implied by its units, this O&M cost is variable, or fully dependent on wind turbine usage. These amounts are based on a working system using the 225-kW wind turbine.

Table 8. Initial Capital and Balance of Station Costs per 225-kW Wind Turbine

Item	Mainland Cost	Extra Cost for SCI Access	Total SCI Cost 1998
225-kW Wind Turbine	$220,000	$25,000	$245,000
Turbine installation on SCI	75,000	67,180	142,180
225-kW Service Parts	3,000	400	3,400
Turbine Maintenance / Warranty	2,000	2,730	4,730
Turbine Siting	3,100	2,000	5,100
Turbine Foundation	90,000	41,000	131,000
Project Engineering	25,000	5,500	30,500
Trenching & Land Improvements	5,000	8000	13,000
Electrical Infrastructure	80,000	23,000	103,000
Electrical Maintenance / Warranty	4,000	3,600	7,600
Miscellaneous Supplies	20,000	6,157	26,157
Total	307,100	159,567	$466,667

6.4 Cost Savings

Once all of the engineering and cost data were ready, an economic assessment was performed according to the procedure used in Hunter [4].

The $2,166,020 capital investment (ICC+BOS) in the three-turbine hybrid system produced 1112 MWh of wind energy between October 1999 and September 2000, saving 333.2 kl (88,028 gal) of fuel. Total energy production during this period was 7795 MWh, diesel energy 6,683 MWh, and fuel consumption 2003 kl (529,078 gal). This saved $339,131 in operating costs over pure diesel generation, giving an 6.4 year simple payback period, 14.6% internal rate of return, $0.197/kWh wind COE, and reducing the system COE from $0.450/kWh to $0.425/kWh. This would give net savings of $0.025/kWh, or $195,000 per year. Using the EPRI TAG approach gives a wind energy COE = (ICC×FCR)/AEP + O&M = (711667×0.102)/1112088 + 0.01 = $0.075/kWh. The complete economic tables can be found in Appendix E.

7.0 Conclusions

San Clemente Island has a moderate wind resource, with an annual average wind speed of 6.0 m/s (11.7 knots) as measured by NREL and the NFESC at the Met-2 tower wind site location from the 1995 through July 30, 2000 data collection period. Recognizing this, the recently constructed wind-diesel hybrid energy system was modeled to examine its performance and economics, as well as the merits of adding more wind energy generation. Using generally conservative assumptions (unfavorable to wind energy) in the model, the hybrid system displayed favorable operation and economics.

The three 225-kW wind turbines installed at SCI demonstrated a wind energy COE of $0.197/kWh, which helps reduce the wind-diesel hybrid system COE from the baseline $0.450/kWh to $0.425/kWh. This reduces system COE by 5.6%. The simple payback period is 6.4 years, the internal rate of return 14.6%. These results can vary depending on annual wind speeds.

Different economic assumptions, such as higher and lower inflation, do not appear to have much impact on the results. Because cost and savings components are well distributed, there does not appear to be a dominant factor affecting the economic results. Factors that could affect the results include the actual capital and installation costs of the wind equipment, diesel-fuel costs, and diesel system O&M and overhaul costs.

This work presented a study of the SCI wind-diesel hybrid system using three operational wind turbines. For the operating and economic conditions examined, it appears wind energy is cost effective in this application. We believe these conditions are realistic but regret the lack of complete cost data on the existing diesel system. Certainly many alternatives to these cases merit consideration. For instance, it appears that the wind penetration could be increased, thus producing further, yet diminishing, savings.

Moreover, excess electrical energy should not be curtailed or wasted on dump loads; rather, it should be used for beneficial purposes, provided those purposes make economic sense. Within the SCI electrical grid, such benefits may be realized by using excess wind energy for deferrable loads such as the SCI reverse-osmosis water system, water heating, or space heating.

To gain lasting value for the wind-diesel generation system operations, preventative maintenance schedules and equipment overhauls must be maintained properly. This also includes maintenance and calibration of the entire SCI electrical network (including switch-gear, relays, power lines, etc.).

References

1. McKenna, E. and Olsen, T. *Performance and Economics of a Wind Diesel Hybrid Energy System: Naval Air Landing Field, San Clemente Island, California*. NREL/SR-500-24663, National Renewable Energy Laboratory, Golden, CO, July 1999.

2. Marriott, Ken, et al. *Operational / Land Use Compatibility Study for NALF San Clemente Island.* KTU+A under Southwest Division Contract # N68711-91-C-0035 for USN NAS North Island Staff Civil Engineers, 1983.

3. Elliott, D.L., et al. *Wind Energy Resource Atlas of the United States*. DOE/CH10093-Pacific Northwest Laboratory, Richland, WA, March 1987.

4. Hunter, R. and Elliott, G. *Wind Diesel Systems*. Cambridge University Press, 1994.

5. Bialasiewicz, J.D, et al. Renewable Energy Power System Modular Simulator. NREL/TP-500-25951, National Renewable Energy Laboratory, Golden, CO, October 1999.

Appendix A. Reactive Power Recommendations

This appendix contains a report on reactive power recommendations from RMH Group, an independent civil and electrical facilities engineering firm.

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San Clemente Island, Power Plant KVAR Operations Recommendations

From: Roy Trygstad, P.E., Senior Electrical Engineer, The RMH Group

Through: Ed McKenna

Sent: September 20, 1999

To: Scott Davis, SCI_PWC Utilities Supervisor

CC: Fred Pradels; Dan Severson; Brian Cable; Joyce Sengpaseuth

Subject: **(Revision 1) Wind Turbine KVAR Study for a three turbine operation**

The San Clemente Island Power Plant presently has its KVAR alarm set for 390 KVAR. This setting was recommended for the first two 225-kW MICON wind turbines. With the addition of the third 225-kW wind turbine the Diesel KVAR setting should be now set to 750 KVAR. Each wind turbine will require KVAR from the diesel generators to operate. It should be noted that as long as the Diesel Generators KVAR capability is not exceeded, then there should not be an alarm.

The overall settings should never exceed the 2-500 kW, KVAR rating of 750 KVAR
With #2 and #3 Diesels operating, the rated KVAR for the two would be 375+900 KVAR
The high KVAR reading is really not a problem for the Diesel Generators.

The San Clemente Island Power Plant Diesel Engine Generators are rated at:

#1 & #2	500 kW, 375 KVAR, 625 KVA @ 0.8 PF
# 4	750 kW, 562 KVAR, 937 KVA @ 0.8 PF
# 3	1200 kW, 900 KVAR, 1500 KVA @ 0.8 PF

The High KVAR Alarm should be set for the Diesel Generator that is on line:

Examples:
2 each 500 kW Generators on line, then set for a 750 KVAR alarm
1 each 500 kW plus 750 kW Generator on line, then set for a 750 KVAR alarm
1 each 1200 kW Generator on line, then set for a 750 KVAR alarm

When the wind is low; the wind turbines small 40-kW generator windings are in operation. When the wind turbine is operating less than 25-kW output, it will draw about 35 KVAR. When the wind generation exceeds 25-kW by each wind turbine a 37.5 KVAR capacitor is turned on at the turbines control panel, thus reducing the KVAR requirement from the Diesel Generator.

Above 40-kW, the wind turbines main 225-kW generator windings are in operation with the single 37.5 KVAR capacitor. When the 60-kW output generation is reached, a second 37.5 KVAR capacitor is turned on; at the 140-kW level, a third 25 KVAR capacitor is added for a total of 100 KVAR capacitance for the 225-kW generator windings.

This chart is a load evaluation study, that shows the effect of the three wind turbines generation with the diesel generators with a constant grid load of 750-kW at .93 PF.

GRID LOAD			WIND TURBINE GENERATORS				DIESEL GENERATORS				4160 VOLT
			(1)	(2)	(3)		(4)				
KW	KVAR	PF	% WT	kW	KVAR	Note	kW	KVAR	KVA	PF	AMPS
750	290	.93	0 %	0	0		750	290	806	.93	112
750	290	.93	4.4%	30	100	(5)	720	390	819	.88	114
750	290	.93	18%	120	25	(6)	630	315	704	.90	98
750	290	.93	22 %	150	225	(7)	600	514	789	.76	109
750	290	.93	50 %	337	138	(8)	413	428	598	.69	83
750	290	.93	75 %	506	120	(9)	249	410	477	.52	66.25
875	290	.95	100 %	675	207	(9) (10)	200	497	535	.37	74

This is a load evaluation study, showing the effect of the three wind turbines generating on the diesel generator's grid with a constant grid load of 1200-kW at .93 PF.

1200	474	.93	0	0	0		1200	474	1290	.93	179
1200	474	.93	4.4 %	30	100	(5)	1170	574	1303	.90	181
1200	474	.93	18 %	120	25	(6)	1080	499	1187	.91	165
1200	474	.93	22 %	150	225	(7)	1050	699	1261	.83	175
1200	474	.93	50 %	337	138	(8)	863	612	1058	.82	147
1200	474	.93	75 %	506	120	(9)	694	594	913	.76	126
1200	474	.93	100 %	675	207	(9)	525	681	860	.61	119

1. *% of 225-kW Wind Turbines*
2. *kW output of 3 Wind Turbines*
3. *KVAR Requirement of 3 Wind Turbines with Capacitor Banks (Staged)*
4. *Load on Diesels (Combined)*
5. *With 0 - Capacitive Banks; 40-kW Turbine Windings.*
6. *With 1 - 37½ KVAR Capacitor Bank*
7. *225-kW Turbine 1 – 37 ½ KVAR Capacitor*
8. *225-kW Turbine 2 – 37 ½ = 75 KVAR Capacitor Bank*
9. *225-kW Turbine 2 – 37 ½ + 1- 25 =100 KVAR Capacitor Bank*
10. *125-kW Load Bank Added*

Roy Trygstad, P.E.
Senior Electrical Engineer

Appendix B. SCI 1998-2000 Power Plant Production Reports

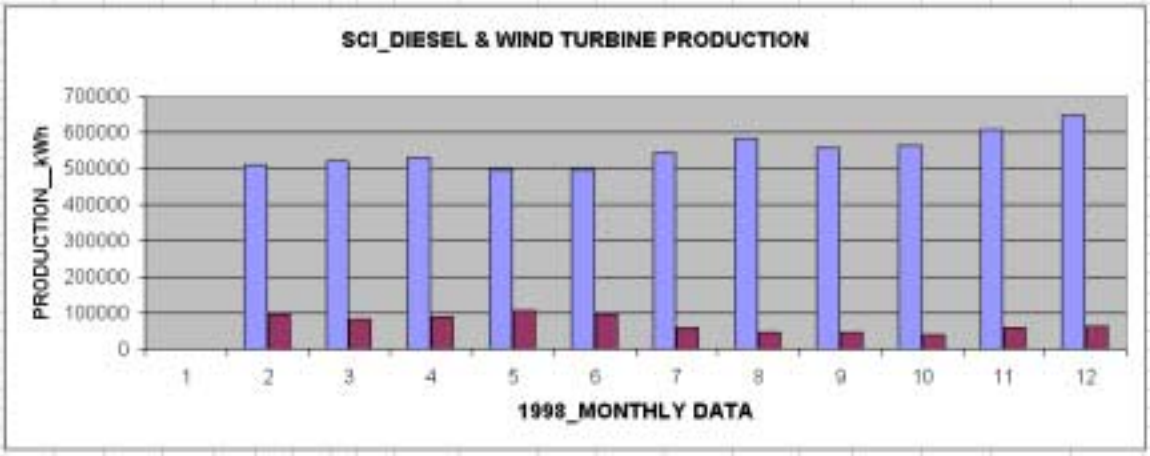
SCI 1998-2000 power plant production reports display the measured wind turbine and diesel electrical energy production contributing to the total San Clemente Island electrical demand. These spreadsheets include fuel usage, individual diesel operation and production, individual wind turbine operation and production, operational efficiencies, and emissions estimates.

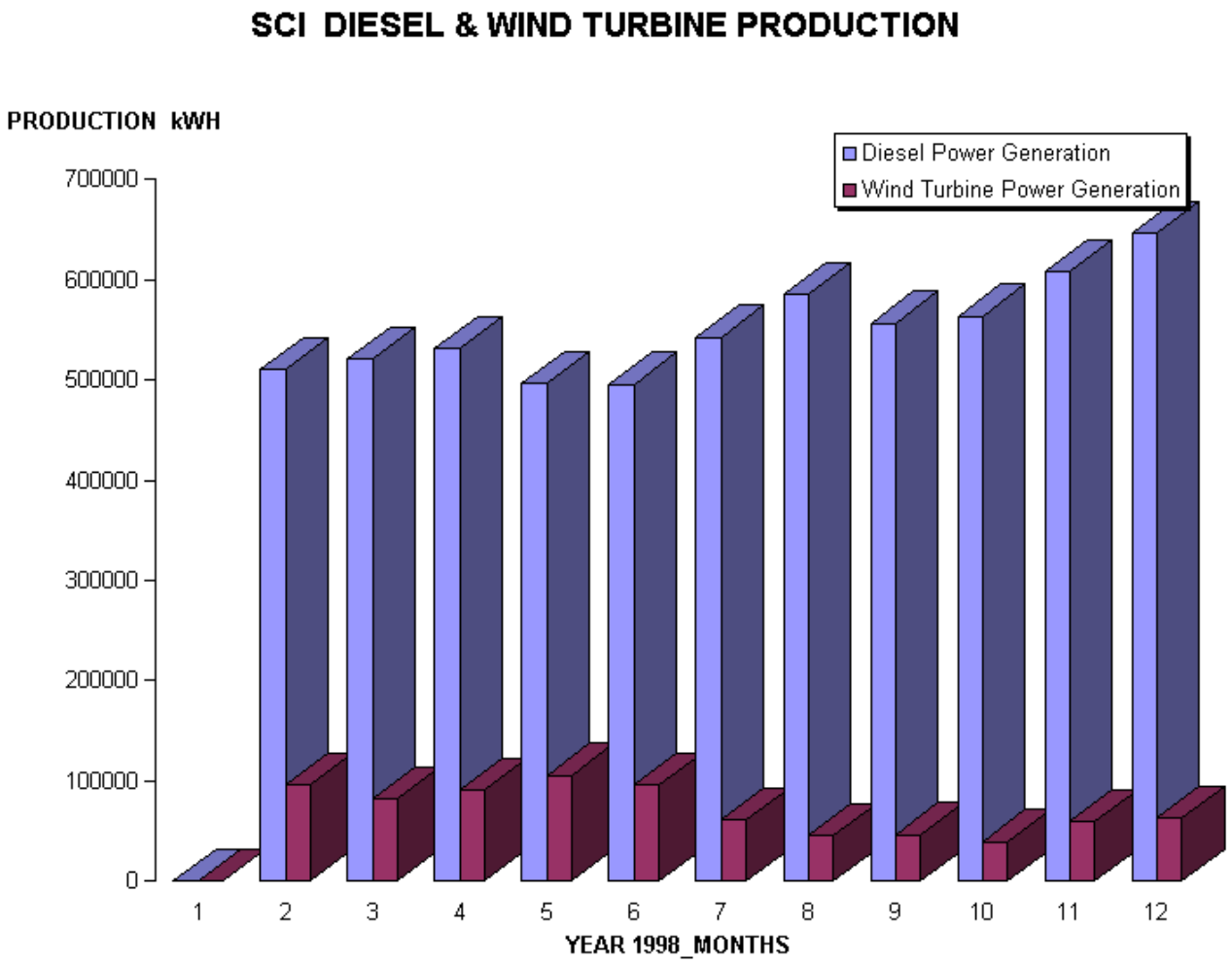
San Clemente Island, CA
1998 Electrical Production and Emission Savings

	Fuel & Lube Oil Used				225kW Wind Turbines														Total Diesel		Tot. WT	Grid Load
	Daily		Total									225kW_WT-1		225kW_WT-2		225 kW_WT-3		KWH			KWH	Tot. KWH
Date	Fuel	Lube	Fuel	Lube								Monthly	CUM	Monthly	CUM	Monthly	CUM	Monthly	CUM		Monthly	Monthly
JAN_00	0	0.0	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0
FEB_00	42580	486.6	42580	486.6	0	0	0	0	0	0	0	38122	38122	57757	57757	0	0	510069	510069		95879	605947
MAR_00	45250	387.4	45250	387.4	0	0	0	0	0	0	0	37839	75961	44341	102098	0	0	520600	1030669		82180	602980
APR_00	43710	309.9	43710	309.9	0	0	0	0	0	0	0	46161	122122	44819	146917	0	0	531300	1562168		90980	622280
MAY_00	40940	287	40940	287.0	0	0	0	0	0	0	0	53621	175743	52120	199037	0	0	488300	2050468		105741	594041
JUN_00	41780	292	41780	292.0	0	0	0	0	0	0	0	49255	224998	46972	246009	0	0	495600	2554069		96227	591827
JUL_00	45251	289.5	45251	289.5	0	0	0	0	0	0	0	31481	256479	29385	275394	0	0	542150	3096219		60866	603016
AUG_00	48700	295	48700	295.0	0	0	0	0	0	0	0	23649	280128	21977	297371	0	0	584650	3681068		45626	630476
SEP_00	45736	585	45736	585.0	0	0	0	0	0	0	0	23594	303722	22423	319794	0	0	555770	4236846		46017	601785
OCT_00	49441	360.5	49441	360.5	0	0	0	0	0	0	0	20356	324078	19511	339305	0	0	563150	4799996		39867	603017
NOV_00	51180	528	51180	528.0	0	0	0	0	0	0	0	32155	356233	27362	366667	0	0	607600	5407596		59517	667117
DEC_00	55380	373.7	55380	373.7	0	0	0	0	0	0	0	28516	385749	33522	400189	0	0	645400	6052996		63838	708438
			508948										385749		400189		0		0			

MONTHLY TOTAL KWH PRODUCED	6838934
KWH PRODUCED PER GAL OF #2 DIESEL FUEL	11.89
DIESEL GENERATION PRODUCTION EFFICIENCY	29.63%
% WIND TURBINE KWH PRODUCED TO TOTAL GRID	11.49%
FUEL SAVINGS BY WIND TURBINE OPERATIONS IN GALLONS (AVOIDED GALLONS USED)	60883

AIR EMISSIONS AVOIDED BY WIND TURBINES IN POUNDS (TOTAL): CO2 = 1484853; CO = 8601; NOx = 39927; SO2 = 2626; PM<10 = 2887; TOC = 3250; Aldehydes = 634



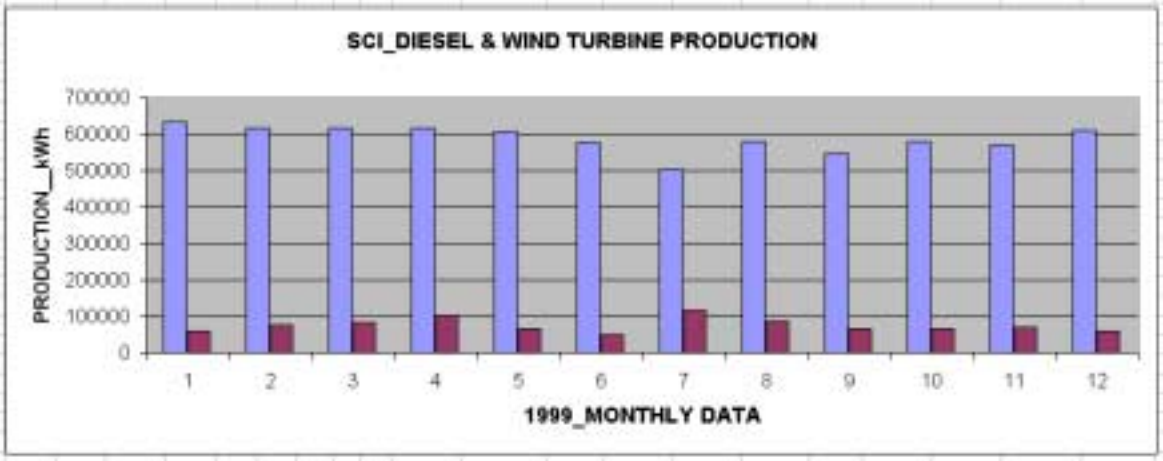

SCI DIESEL & WIND TURBINE PRODUCTION
PRODUCTION kWH
Diesel Power Generation
Wind Turbine Power Generation
700000
600000
500000
400000
300000
200000
100000
0
1
2
3
4
5
6
7
8
9
10
11
12
YEAR 1998_MONTHS

San Clemente Island, CA
1999 Electrical Production and Emission Savings

	Fuel & Lube Oil Used												225kW Wind Turbines						Total Diesel		Tot. WT	Grid Load
	Daily		Total										225kW_WT-1		225kW_WT-2		225 kW_WT-3		kWH		kWH	Tot. kWH
Date	Fuel	Lube	Fuel	Lube									Monthly	CUM	Monthly	CUM	Monthly	CUM	Monthly	CUM	Monthly	Monthly
JAN_99	54880	453.6	54880	453.6	0	0	0	0	0	0	0		20982	20982	39333	39333	0	0	634550	634550	59315	693865
FEB_99	52500	627.7	52500	627.7	0	0	0	0	0	0	0		36368	65350	38285	69618	0	0	616700	1251250	75053	692353
MAR_99	60540	380	60540	380.0	0	0	0	0	0	0	0		39735	105085	42865	112483	0	0	616700	1867950	82570	699270
APR_99	52150	587.2	52150	587.2	0	0	0	0	0	0	0		51072	156157	52122	164605	0	0	617750	2485700	103194	720944
MAY_99	52370	417.2	52370	417.2	0	0	0	0	0	0	0		34415	190548	33180	197785	0	0	605050	3090750	67595	672645
JUN_99	49630	426.6	49630	426.6	0	0	0	0	0	0	0		26248	216795	24545	222330	0	0	578200	3668950	50794	628994
JUL_99	43890	344.6	43890	344.6	0	0	0	0	0	0	0		44648	261443	42381	264881	28471	28471	502600	4171550	115480	618080
AUG_99	48880	421	48880	421.0	0	0	0	0	0	0	0		37888	299339	34804	299685	15538	44009	580650	4752200	88208	668858
SEP_99	46750	514.6	46750	514.6	0	0	0	0	0	0	0		34284	333593	32313	331998	0	44009	546700	5298900	66597	613297
OCT_99	47285	491	47285	491.0	0	0	0	0	0	0	0		30917	364410	28997	361895	7181	51190	578886	5877786	67995	646881
NOV_99	43229	356.6	43229	356.6	0	0	0	0	0	0	0		23774	388184	23662	385757	23560	74750	569850	6447636	71298	641138
DEC_99	49690	453.0	49690	453.0	0	0	0	0	0	0	0		19938	408090	20752	406509	20855	95605	611100	7058736	61513	672613
			601792											408090		406509		95605		0		

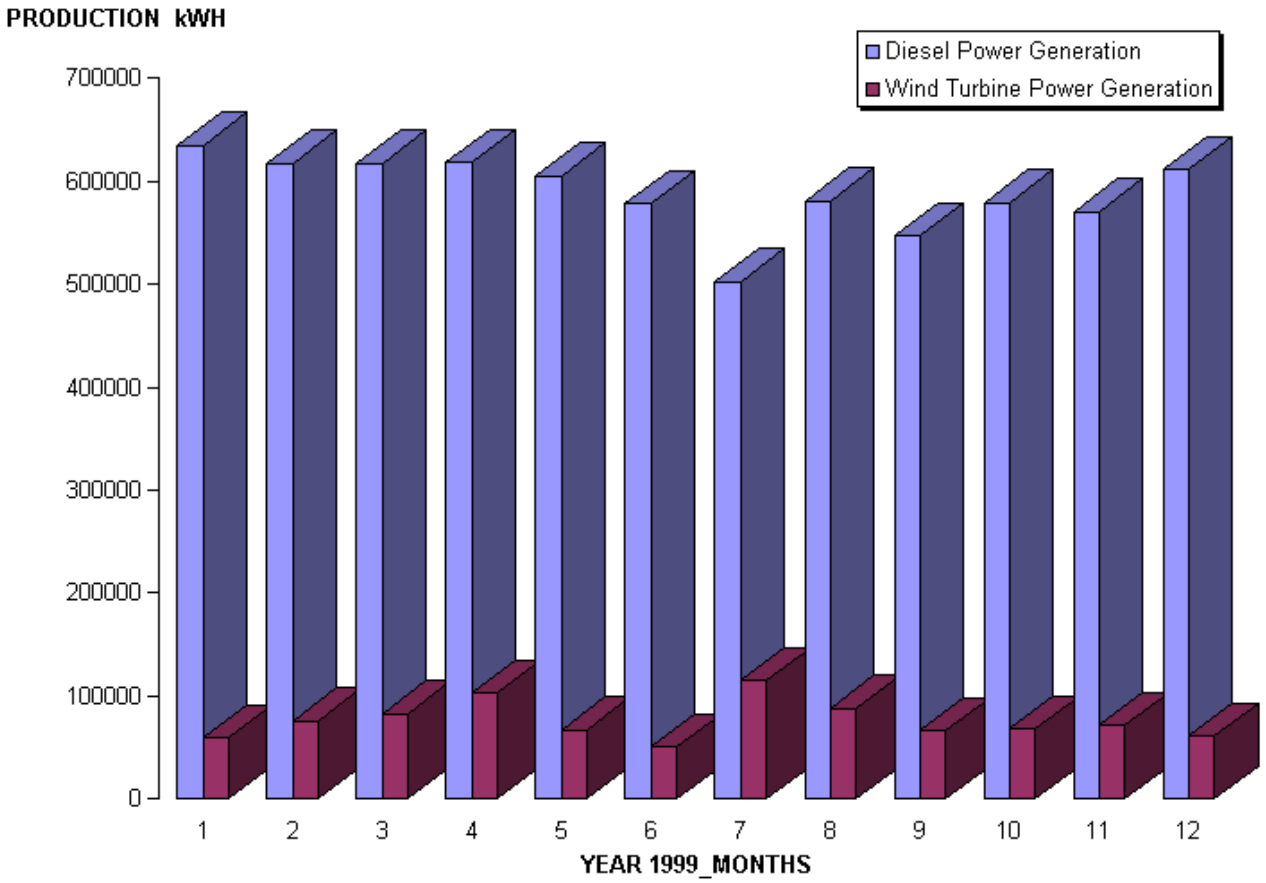
MONTHLY TOTAL KWH PRODUCED	7968940
KWH PRODUCED PER GAL OF #2 DIESEL FUEL	11.73
DIESEL GENERATION PRODUCTION EFFICIENCY	29.22%
% WIND TURBINE KWH PRODUCED TO TOTAL GRID	11.42%
FUEL SAVINGS BY WIND TURBINE OPERATIONS IN GALLONS (AVOIDED GALLONS USED)	77080

AIR EMISSIONS AVOIDED BY WIND TURBINES IN POUNDS (TOTAL) CO2 = 1743570 CO = 19180 NOx = 16885 SO2 = 3083
PM<10 = 3256 TOC = 3827 Aldehydes = 744



October 29–November 4 – Turbine #1 & #2 shut down – construction activities for Turbine #3 – lost production ~ 10,000 kWh
December 5–6 – Turbine #1 & #2 shut down for planned maintenance and modifications – lost production ~ 15,000 kWh

SCI DIESEL & WIND TURBINE PRODUCTION



San Clemente Island, CA
January 1999
Electrical Production, Fuel Use and Emission Factors

									SCI Power Plant Production Report											
	Fuel & Lube Oil Used								Diesel Generators				Wind Turbines				Total Diesel		Tot. WT	Grid Load
	Daily		Total		Daily Pk Demand		Avg	500 KW	500 KW	1.2 MW	750 KW	225 KW WT-1		225 KW WT-2		KWH		KWH	Tot. KWH
Date	Fuel	Lube	Fuel	Lube	Time	Load	PF	DE-1	DE-2	DE-3	DE-4	Daily	CUM	Daily	CUM	Daily	CUM	Daily	Daily
1-Jan	1510	27.4	1510	27.4	100	803	95	3150	0	0	14000	606	606	742	742	17150	17150	1348	18498
2-Jan	1580	0	3090	27.4	2000	882	95	5250	0	0	14000	44	650	90	832	19250	36400	134	19384
3-Jan	1540	0	4630	27.4	1900	817	94	5250	0	0	12250	267	917	288	1120	17500	53900	555	18055
4-Jan	1700	24.2	6330	51.6	1800	945	95	7350	0	0	12250	312	1229	400	1520	19600	73500	712	20312
5-Jan	1770	22	8100	73.6	700	1065	94	7350	0	0	12250	397	1626	384	1904	19600	93100	781	20381
6-Jan	1840	10	9940	83.6	600	1081	95	7350	0	0	14000	292	1918	231	2135	21350	114450	523	21873
7-Jan	1780	0	11720	83.6	2000	1110	94	8400	0	0	14000	1493	3411	1402	3537	22400	136850	2895	25295
8-Jan	1630	0	13350	83.6	1000	1025	94	2100	0	16800	0	1255	4666	1224	4761	18900	155750	2479	21379
9-Jan	1630	20	14980	103.6	1800	925	95	0	0	19600	0	91	4757	180	4941	19600	175350	271	19871
10-Jan	1630	8	16610	111.6	1800	963	95	1050	0	16800	0	0	4757	34	4975	17850	193200	34	17884
11-Jan	1800	35	18410	146.6	1900	1137	94	3150	0	19600	0	566	5323	530	5505	22750	215950	1096	23846
12-Jan	2010	10	20420	156.6	800	1190	95	5250	0	19600	0	432	5755	598	6103	24850	240800	1030	25880
13-Jan	2090	22	22510	178.6	700	1238	95	7350	0	16800	0	3	5758	100	6203	24150	264950	103	24253
14-Jan	1970	22	24480	200.6	600	1204	95	8400	0	14000	0	194	5952	691	6894	22400	287350	885	23285
15-Jan	1690	22	26170	222.6	700	1023	0	2100	0	16800	0	288	6240	365	7259	18900	306250	653	19553
16-Jan	1430	17.6	27600	240.2	2300	902	95	0	0	16800	0	2271	8511	2181	9440	16800	323050	4452	21252
17-Jan	1410	20	29010	260.2	1900	997	95	2100	0	19600	0	517	9028	473	9913	21700	344750	990	22690
18-Jan	1680	0	30690	260.2	900	928	95	0	0	19600	0	310	9338	307	10220	19600	364350	617	20217
19-Jan	1880	40	32570	300.2	1900	1209	95	5250	0	16800	0	687	10025	684	10904	22050	386400	1371	23421
20-Jan	1650	0	34220	300.2	1800	1250	90	4200	0	14000	0	3643	13668	3476	14380	18200	404600	7119	25319
21-Jan	1460	0	35680	300.2	700	1210	86	1050	0	16800	0	4306	17974	4102	18482	17850	422450	8408	26258
22-Jan	1890	35.5	37570	335.7	600	1160	91	4200	0	14000	1750	326	18300	344	18826	19950	442400	670	20620
23-Jan	1880	15	39450	350.7	700	1075	92	8400	0	0	12250	191	18491	180	19006	20650	463050	371	21021
24-Jan	1750	19.9	41200	370.6	1900	1110	90	8400	0	0	14000	1608	20099	1590	20596	22400	485450	3198	25598
25-Jan	1870	19.8	43070	390.4	1900	1250	91	8400	0	0	12250	1691	21790	1610	22206	20650	506100	3301	23951
26-Jan	1780	0	44850	390.4	1900	1395	90	9450	0	0	14000	3474	25264	3367	25573	23450	529550	6841	30291
27-Jan	2080	0	46930	390.4	800	1381	95	7350	0	14000	5250	1239	26503	1360	26933	26600	556150	2599	29199
28-Jan	2160	13.2	49090	403.6	600	1330	95	8400	0	19600	0	333	26836	330	27263	28000	584150	663	28663
29-Jan	2060	35	51150	438.6	700	1280	95	7350	0	16800	0	230	27066	237	27500	24150	608300	467	24617
30-Jan	1880	0	53030	438.6	600	1104	95	5250	0	16800	0	53	27119	256	27756	22050	630350	309	22359
31-Jan	1650	15	54680	453.6	2300	1031	94	4200	0	14000	0	1863	28982	2577	30333	4200	634550	4440	22640
MONTHLY TOTAL KWH PRODUCED																				693865
KWH PRODUCED PER GAL OF #2 DIESEL FUEL																				11.60
DIESEL GENERATION PRODUCTION EFFICIENCY																				28.91%
% WIND TURBINE KWH PRODUCED TO TOTAL GRID																				8.55%
FUEL SAVINGS BY WIND TURBINE OPERATIONS IN GALLONS (AVOIDED GALLONS USED)																				5111
AIR EMISSIONS AVOIDED BY WIND TURBINES IN POUNDS (TOTAL)																				
					CO2 =	114844		CO =	665		NOx =	3088		SO2 =	203				
					PM<10 =	217		TOC =	252		Aldehydes =	49							

San Clemente Island, CA
February 1999
Electrical Production, Fuel Use and Emission Factors

SCI Power Plant Production Report

	Fuel & Lube Oil Used							Diesel Generators				Wind Turbines				Total Diesel KWH		Tot. WT KWH	Grid Load Tot. KWH
	Daily		Total		Daily Pk Demand		Avg	500 KW	500 KW	1.2 MW	750 KW	225 KW WT-1		225 KW WT-2					
Date	Fuel	Lube	Fuel	Lube	Time	Load	PF	DE-1	DE-2	DE-3	DE-4	Daily	CUM	Daily	CUM	Daily	CUM	Daily	Daily
1-Feb	2000	37	2000	37.0	2000	1109	95	7350	0	16800	0	360	360	508	508	24150	24150	868	25018
2-Feb	2090	12.3	4090	49.3	700	1171	96	4200	0	16800	1750	83	443	403	911	22750	46900	486	23236
3-Feb	2150	18.5	6240	67.8	600	1260	92	9450	0	16800	0	0	443	140	1051	26250	73150	140	26390
4-Feb	2140	20	8380	87.8	2100	1280	93	7350	0	16800	0	845	1288	1187	2238	24150	97300	2032	26182
5-Feb	1960	37.2	10340	125.0	700	1220	94	4200	2100	16800	0	1127	2415	1083	3321	23100	120400	2210	25310
6-Feb	1790	0	12130	125.0	1800	1105	94	0	5250	8400	7000	1344	3759	1274	4595	20650	141050	2618	23268
7-Feb	1870	17.6	14000	142.6	1900	1115	94	0	9450	0	14000	781	4540	763	5358	23450	164500	1544	24994
8-Feb	1950	20	15950	162.6	1800	1242	96	0	9450	0	14000	460	5000	433	5791	23450	187950	893	24343
9-Feb	1830	0	17780	162.6	1600	1300	96	0	8400	2800	10500	2092	7092	1962	7753	21700	209650	4054	25754
10-Feb	1840	17.6	19620	180.2	700	1360	93	0	6300	11200	3500	2602	9694	3548	11301	21000	230650	6150	27150
11-Feb	1750	14.5	21370	194.7	600	1255	92	0	6300	14000	0	2923	12617	2899	14200	20300	250950	5822	26122
12-Feb	1920	33	23290	227.7	600	1324	94	0	6300	16800	0	515	13132	546	14746	23100	274050	1061	24161
13-Feb	1820	0	25110	227.7	700	1080	94	0	4200	16800	0	852	13984	762	15508	21000	295050	1614	22614
14-Feb	1540	25	26650	252.7	500	1046	90	0	4200	14000	0	3321	17305	3169	18677	18200	313250	6490	24690
15-Feb	1660	15	28310	267.7	600	1118	94	0	3150	16800	0	1903	19208	1855	20532	19950	333200	3758	23708
16-Feb	1850	0	30160	267.7	700	1153	93	0	6300	14000	0	2235	21443	2199	22731	20300	353500	4434	24734
17-Feb	1880	35	32040	302.7	600	1280	94	0	6300	14000	0	2561	24004	2548	25279	20300	373800	5109	25409
18-Feb	1930	0	33970	302.7	700	1118	94	0	7350	16800	0	1781	25785	1669	26948	24150	397950	3450	27600
19-Feb	1930	181	35900	483.7	700	1201	95	5250	0	16800	0	568	26353	530	27478	22050	420000	1098	23148
20-Feb	1840	10	37740	493.7	600	1139	94	7350	0	5600	8750	1030	27383	946	28424	21700	441700	1976	23676
21-Feb	1510	50	39250	543.7	600	1160	95	5250	0	0	12250	3505	30888	4089	32493	17500	459200	7574	25074
22-Feb	1820	0	41070	543.7	600	1172	95	8400	0	0	12250	1078	31966	1785	34278	20650	479850	2863	23513
23-Feb	1940	0	43010	543.7	1800	1140	94	9450	0	0	14000	240	32206	210	34488	23450	503300	450	23900
24-Feb	1960	10	44970	553.7	700	1279	94	6300	0	14000	1750	873	33079	978	35466	22050	525350	1851	23901
25-Feb	1850	28	46820	581.7	1900	1300	93	6300	0	16800	0	2214	35293	2260	37726	23100	548450	4474	27574
26-Feb	1940	0	48760	581.7	700	1144	94	6300	0	16800	0	761	36054	725	38451	23100	571550	1486	24586
27-Feb	1880	46	50640	627.7	700	1060	95	9450	0	0	12250	115	36169	114	38565	21700	593250	229	21929
28-Feb	1860	0	52500	627.7	1800	1049	94	2100	7350	0	14000	199	36368	720	39285	23450	616700	919	24369

MONTHLY TOTAL KWH PRODUCED	682353
KWH PRODUCED PER GAL OF #2 DIESEL FUEL	11.75
DIESEL GENERATION PRODUCTION EFFICIENCY	29.26%
% WIND TURBINE KWH PRODUCED TO TOTAL GRID	10.93%
FUEL SAVINGS BY WIND TURBINE OPERATIONS IN GALLONS (AVOIDED GALLONS USED)	6440

AIR EMISSIONS AVOIDED BY WIND TURBINES IN POUNDS (TOTAL)

CO2 =	144708	CO =	838	NOx =	3891	SO2 =	256
PM<10 =	274	TOC =	318	Aldehydes =	62		

San Clemente Island, CA
March 1999
Electrical Production, Fuel Use, and Emission Factors

SCI Power Plant Production Report

	Fuel & Lube Oil Used							Diesel Generators				Wind Turbines				Total Diesel		Tot. WT	Grid Load
	Daily		Total		Daily Pk Demand		Avg	500 KW	500 KW	1.2 MW	750 KW	225 KW WT-1		225 KW WT-2		KWH		KWH	Tot. KWH
Date	Fuel	Lube	Fuel	Lube	Time	Load	PF	DE-1	DE-2	DE-3	DE-4	Daily	CUM	Daily	CUM	Daily	CUM	Daily	Daily
1-Mar	1780	0	1780	0.0	2300	1139	93	0	7350	0	12250	995	995	1204	1204	19600	19600	2199	21799
2-Mar	1830	0	3610	0.0	2000	1181	92	1050	7350	0	12250	1892	2887	1770	2974	20650	40250	3662	24312
3-Mar	1710	0	5320	0.0	600	1254	94	0	7350	2800	10500	3385	6272	3355	6329	20650	60900	6740	27390
4-Mar	1760	0	7080	0.0	700	1305	94	4200	0	16800	0	2633	8905	2536	8865	21000	81900	5169	26169
5-Mar	2090	17	9170	17.0	700	1211	95	7350	0	16800	0	2	8907	56	8921	24150	106050	58	24208
6-Mar	2110	0	11280	17.0	2000	1203	94	9450	0	2800	12250	211	9118	240	9161	24500	130550	451	24951
7-Mar	1860	0	13140	17.0	1900	1265	94	9450	0	2800	12250	1014	10132	2126	11287	24500	155050	3140	27640
8-Mar	1940	20	15080	37.0	2100	1215	95	8400	0	11200	3500	1312	11444	1313	12600	23100	178150	2625	25725
9-Mar	2020	20	17100	57.0	1900	1352	94	8400	0	19600	0	1174	12618	1352	13952	28000	206150	2526	30526
10-Mar	1950	0	19050	57.0	1900	1382	91	8400	0	16800	0	2888	15506	2896	16848	25200	231350	5784	30984
11-Mar	2030	55	21080	112.0	800	1395	91	7350	0	16800	0	1595	17101	1883	18731	24150	255500	3478	27628
12-Mar	1890	0	22970	112.0	500	1211	93	4200	0	19600	0	367	17468	362	19093	23800	279300	729	24529
13-Mar	1830	0	24800	112.0	2000	1070	94	3150	0	16800	0	375	17843	358	19451	19950	299250	733	20683
14-Mar	1920	22	26720	134.0	2000	1069	94	7350	0	16800	0	410	18253	421	19872	24150	323400	831	24981
15-Mar	1840	22	28560	156.0	1100	1296	94	7350	0	14000	0	1827	20080	1884	21756	21350	344750	3711	25061
16-Mar	1970	0	30530	156.0	600	1146	96	9450	0	14000	0	424	20504	622	22378	23450	368200	1046	24496
17-Mar	2290	40	32820	196.0	1900	1228	96	9450	0	16800	0	181	20685	346	22724	26250	394450	527	26777
18-Mar	2180	18	35000	214.0	2200	1205	96	7350	3150	16800	0	100	20785	123	22847	27300	421750	223	27523
19-Mar	1980	13	36980	227.0	700	1151	96	0	8400	8400	5250	456	21241	656	23503	22050	443800	1112	23162
20-Mar	1890	0	38870	227.0	2100	1043	96	0	8400	0	14000	338	21579	398	23901	22400	466200	736	23136
21-Mar	1840	35	40710	262.0	700	1027	96	2100	7350	0	12250	1007	22586	1115	25016	21700	487900	2122	23822
22-Mar	2620	9	43330	271.0	600	1090	96	9450	0	0	10500	2189	24775	2354	27370	19950	507850	4543	24493
23-Mar	1920	22	45250	293.0	2000	1128	96	9450	0	5600	10500	1856	26631	1796	29166	25550	533400	3652	29202
24-Mar	2100	0	47350	293.0	600	1244	95	8400	0	16800	0	1234	27865	1302	30468	25200	558600	2536	27736
25-Mar	2180	13	49530	306.0	1200	1258	95	9450	0	16800	0	641	28506	1139	31607	26250	584850	1780	28030
26-Mar	1880	38	51410	344.0	2300	1114	94	6300	0	16800	0	1566	30072	1840	33447	23100	607950	3406	26506
27-Mar	1960	0	53370	344.0	600	1005	96	7350	0	14000	0	170	30242	163	33610	21350	629300	333	21683
28-Mar	1950	0	55320	344.0	600	1060	95	1050	8400	2800	8750	752	30994	675	34285	21000	650300	1427	22427
29-Mar	1930	0	57250	344.0	2100	1125	94	0	10500	0	14000	115	31109	138	34423	24500	674800	253	24753
30-Mar	1680	16	58930	360.0	800	996	93	0	8400	0	10500	3607	34716	3500	37923	18900	693700	7107	26007
31-Mar	1610	20	60540	380.0	900	1325	88	0	7350	0	10500	4989	39705	4942	42865	10500	704200	9931	27781

MONTHLY TOTAL KWH PRODUCED	786770
KWH PRODUCED PER GAL OF #2 DIESEL FUEL	11.63
DIESEL GENERATION PRODUCTION EFFICIENCY	28.98%
% WIND TURBINE KWH PRODUCED TO TOTAL GRID	10.49%
FUEL SAVINGS BY WIND TURBINE OPERATIONS IN GALLONS (AVOIDED GALLONS USED)	7899

AIR EMISSIONS AVOIDED BY WIND TURBINES IN POUNDS (TOTAL)

CO2 =	159496	CO =	924	NOx =	4289	SO2 =	282
PM<10 =	301	TOC =	350	Aldehydes =	68		

San Clemente Island, CA
April 1999
Electrical Production, Fuel Use, and Emission Factors

SCI Power Plant Production Report

	Fuel & Lube Oil Used							Diesel Generators				Wind Turbines				Total Diesel		Tot. WT	Grid Load
	Daily		Total				Avg	500 KW	500 KW	1.2 MW	750 KW	225 KW WT-1		225 KW WT-2		KWH		KWH	Tot. KWH
Date	Fuel	Lube	Fuel	Lube	Daily Pk Time	Demand Load	PF	DE-1	DE-2	DE-3	DE-4	Daily	CUM	Daily	CUM	Daily	CUM	Daily	Daily
1-Apr	1890	24	1890	24.0	700	1340	90	0	5250	16800	0	2797	2797	3006	3006	22050	22050	5803	27853
2-Apr	1760	191	3650	215.0	500	1200	90	0	6300	8400	7000	2144	4941	3084	6090	21700	43750	5228	26928
3-Apr	1590	0	5240	215.0	2400	1225	90	0	5250	0	14000	3724	8665	3577	9667	19250	63000	7301	26551
4-Apr	1590	13.2	6830	228.2	100	1165	90	0	6300	0	12250	2416	11081	2432	12099	18550	81550	4848	23398
5-Apr	1890	0	8720	228.2	2200	1155	90	0	9450	0	14000	1178	12259	1146	13245	23450	105000	2324	25774
6-Apr	2070	0	10790	228.2	900	1275	90	0	9450	0	14000	423	12682	629	13874	23450	128450	1052	24502
7-Apr	1900	41.8	12690	270.0	2300	1222	94	0	9450	0	14000	2438	15120	2582	16456	23450	151900	5020	28470
8-Apr	1910	0	14600	270.0	600	1224	92	0	8400	0	14000	1880	17000	1802	18258	22400	174300	3682	26082
9-Apr	1610	13.2	16210	283.2	800	1193	92	0	7350	0	10500	4052	21052	4823	22881	17850	192150	8675	26525
10-Apr	1960	0	18170	283.2	700	1232	93	0	9450	0	15750	870	21922	853	23734	25200	217350	1723	26923
11-Apr	1920	13.2	20090	296.4	1200	1149	94	0	8400	0	14000	1513	23435	1398	25132	22400	239750	2911	25311
12-Apr	2010	13.2	22100	309.6	600	1205	95	5250	4200	11200	5250	1243	24678	1164	26296	25900	265650	2407	28307
13-Apr	2140	39.6	24240	349.2	1000	1230	95	8400	0	16800	0	508	25184	464	26760	25200	290850	970	26170
14-Apr	2200	0	26440	349.2	1100	1337	94	9450	0	16800	0	315	25499	284	27044	26250	317100	599	26849
15-Apr	2100	30	28540	379.2	800	1230	95	9450	0	16800	0	106	25605	105	27149	26250	343350	211	26461
16-Apr	1470	32	30010	411.2	600	1135	95	7350	0	8400	5250	208	25813	370	27519	21000	364350	578	21578
17-Apr	1900	0	31910	411.2	600	948	95	0	5250	0	12250	394	26207	365	27884	17500	381850	759	18259
18-Apr	1540	35	33450	446.2	2000	870	94	0	5250	0	12250	645	26852	603	28487	17500	399350	1248	18748
19-Apr	1630	0	35080	446.2	1800	1010	94	0	6300	0	14000	938	27790	850	29337	20300	419650	1788	22088
20-Apr	1380	0	36460	446.2	2100	956	94	0	3150	0	12250	3254	31044	3049	32386	15400	435050	6303	21703
21-Apr	1300	0	37760	446.2	2100	1125	86	0	4200	0	10500	3323	34367	3248	35634	14700	449750	6571	21271
22-Apr	1600	9.3	39360	455.5	800	1089	90	0	4200	0	10500	2053	36420	1979	37613	14700	464450	4032	18732
23-Apr	1740	29.4	41100	484.9	500	1032	94	0	8400	2800	14000	379	36799	394	38007	25200	489650	773	25973
24-Apr	1600	0	42700	484.9	2000	905	94	0	0	16800	0	144	36943	144	38151	16800	506450	288	17088
25-Apr	1470	0	44170	484.9	2000	894	93	0	0	19600	0	1071	38014	1026	39177	19600	526050	2097	21697
26-Apr	1670	27.3	45840	512.2	2100	964	94	0	2100	16800	0	1408	39422	1383	40560	18900	544950	2791	21691
27-Apr	1600	0	47440	512.2	2000	1030	89	0	3150	16800	0	2313	41735	2270	42830	19950	564900	4583	24533
28-Apr	1430	15	48870	527.2	1400	1215	94	1050	0	14000	0	4605	46340	4620	47450	15050	579950	9225	24275
29-Apr	1500	15	50370	542.2	700	1204	95	1050	0	16800	0	4033	50373	4004	51454	17850	597800	8037	25887
30-Apr	1780	25	52150	567.2	1400	1130	94	3150	0	16800	0	699	51072	668	52122	19950	617750	1367	21317
	0	0	52150	567.2	0000	0	0	0	0	0	0	0	51072	0	52122	0	617750	0	0

MONTHLY TOTAL KWH PRODUCED	720944
KWH PRODUCED PER GAL OF #2 DIESEL FUEL	11.85
DIESEL GENERATION PRODUCTION EFFICIENCY	29.51%
% WIND TURBINE KWH PRODUCED TO TOTAL GRID	14.31%
FUEL SAVINGS BY WIND TURBINE OPERATIONS IN GALLONS (AVOIDED GALLONS USED)	8712
AIR EMISSIONS AVOIDED BY WIND TURBINES IN POUNDS (TOTAL)	

CO2 =	195739	CO =	1134	NOx =	5263	SO2 =	346
PM<10 =	370	TOC =	430	Aldehydes =	84		

San Clemente Island, CA
May 1999
Electrical Production, Fuel Use, and Emission Factors

	Fuel & Lube Oil Used							Diesel Generators				Wind Turbines				Total Diesel		Tot. WT	Grid Load
	Daily		Total		Daily Pk Demand		Avg	500 KW	500 KW	1.2 MW	750 KW	225 KW WT-1		225 KW WT-2		KWH		KWH	Tot. KWH
Date	Fuel	Lube	Fuel	Lube	Time	Load	PF	DE-1	DE-2	DE-3	DE-4	Daily	CUM	Daily	CUM	Daily	CUM	Daily	Daily
1-May	1730	30	1730	30.0	2100	1027	95	8400	0	0	10500	712	712	667	667	18900	18900	1379	20279
2-May	1520	0	3250	30.0	2000	1011	94	0	4200	0	12250	2413	3125	2366	3033	16450	35350	4779	21229
3-May	1350	10	4600	40.0	2000	1118	94	0	2100	0	14000	4331	7456	4309	7342	16100	51450	8640	24740
4-May	1610	5	6210	45.0	600	1125	95	0	5250	0	14000	2930	10386	2834	10176	19250	70700	5764	25014
5-May	2040	31.3	8250	76.3	800	1185	95	0	9450	0	15750	90	10476	97	10273	25200	95900	187	25387
6-May	1900	0	10150	76.3	1100	1051	95	0	7350	0	14000	453	10929	396	10669	21350	117250	849	22199
7-May	1630	14	11780	90.3	800	948	93	0	4200	8400	7000	1133	12062	1060	11729	19600	136850	2193	21793
8-May	1540	14	13320	104.3	1800	894	94	0	0	16800	0	679	12741	642	12371	16800	153650	1321	18121
9-May	1540	12.7	14860	117.0	1900	942	95	0	0	19600	0	511	13252	474	12845	19600	173250	985	20585
10-May	1660	18.9	16520	135.9	2000	952	94	0	0	19600	0	271	13523	264	13109	19600	192850	535	20135
11-May	1790	42	18310	177.9	2200	1002	95	7350	0	8400	8750	87	13610	76	13185	24500	217350	163	24663
12-May	1900	12	20210	189.9	1300	1021	95	7350	0	14000	0	256	13866	243	13428	21350	238700	499	21849
13-May	1900	0	22110	189.9	2300	987	95	8400	0	1400	0	102	13968	102	13530	9800	248500	204	10004
14-May	1600	31	23710	220.9	600	1035	95	4200	0	11200	0	1693	15661	1650	15180	15400	263900	3343	18743
15-May	1390	15	25100	235.9	700	865	95	0	3150	0	14000	2263	17924	2270	17450	17150	281050	4533	21683
16-May	1630	0	26730	235.9	900	890	95	0	3150	8400	8750	294	18218	273	17723	20300	301350	567	20867
17-May	1710	20	28440	255.9	700	948	95	1050	0	19600	0	70	18288	66	17789	20650	322000	136	20786
18-May	1710	18	30150	273.9	500	953	95	2100	0	16800	0	908	19196	849	18638	18900	340900	1757	20657
19-May	1480	20	31630	293.9	1000	980	94	1050	0	16800	0	2553	21749	2445	21083	17850	358750	4998	22848
20-May	1660	1.3	33290	295.2	600	920	94	0	5250	5600	10500	2123	23872	2071	23154	21350	380100	4194	25544
21-May	1930	10	35220	305.2	600	1101	95	0	9450	0	14000	64	23936	65	23219	23450	403550	129	23579
22-May	1860	0	37080	305.2	2200	1055	95	0	7350	0	14000	76	24012	71	23290	21350	424900	147	21497
23-May	1830	28	38910	333.2	600	1031	95	0	8400	0	14000	234	24246	212	23502	22400	447300	446	22846
24-May	1680	10	40590	343.2	2200	1005	95	0	7350	0	12250	1797	26043	1709	25211	19500	466800	3506	23006
25-May	1800	0	42390	343.2	600	1022	95	0	8400	0	12250	1163	27206	1085	26296	20650	487450	2248	22898
26-May	1920	18	44310	361.2	1200	1150	94	0	8400	0	14000	809	28015	766	27062	22400	509850	1575	23975
27-May	1800	26	46110	387.2	1900	1070	94	0	7350	0	14000	1024	29039	937	27999	21350	531200	1961	23311
28-May	1610	0	47720	387.2	700	1000	93	0	5250	8400	7000	1490	30529	1427	29426	20650	551850	2917	23567
29-May	1550	2	49270	389.2	2300	1035	93	0	0	16800	0	1590	32119	1541	30967	16800	568650	3131	19931
30-May	1560	28	50830	417.2	2100	970	93	0	0	19600	0	1268	33387	1197	32164	19600	588250	2465	22065
31-May	1540	0	52370	417.2	2200	905	93	0	0	16800	0	1032	34419	1016	33180	16800	605050	2048	18848
MONTHLY TOTAL KWH PRODUCED																			672649
KWH PRODUCED PER GAL OF #2 DIESEL FUEL																			11.55
DIESEL GENERATION PRODUCTION EFFICIENCY																			28.78%
% WIND TURBINE KWH PRODUCED TO TOTAL GRID																			10.05%
FUEL SAVINGS BY WIND TURBINE OPERATIONS IN GALLONS (AVOIDED GALLONS USED)																			5851
AIR EMISSIONS AVOIDED BY WIND TURBINES IN POUNDS (TOTAL)																			
					CO2 =	131466		CO =	762		NOx =	3535		SO2 =	232				
					PM<10 =	249		TOC =	289		Aldehydes =		56						

San Clemente Island, CA
June 1999
Electrical Production, Fuel Use, and Emission Factors

SCI Power Plant Production Report

	Fuel & Lube Oil Used					Diesel Generators						Wind Turbines				Total Diesel KWH		Tot. WT KWH	Grid Load Tot. KWH
	Daily		Total		Peak	500 KW	500 KW	1.2 MW	750 KW	225 KW WT-1		225 KW WT-2		225 KW WT-3					
Date	Fuel	Lube	Fuel	Lube	Load	DE-1	DE-2	DE-3	DE-4	Daily	CUM	Daily	CUM	Daily	CUM	Daily	CUM	Daily	Daily
1-Jun	1740	20	1740	20.0	1105	2100	0	19600	0	680	680	673	673	0	0	21700	21700	1353	23053
2-Jun	1640	30.4	3380	50.4	1046	2100	0	16800	0	1760	2440	1690	2363	0	0	18900	40600	3450	22350
3-Jun	1680	0	5060	50.4	1019	3150	0	16800	0	0	2440	0	2363	0	0	19950	60550	0	19950
4-Jun	1460	0	6520	50.4	1052	4200	0	16800	0	0	2440	0	2363	0	0	21000	81550	0	21000
5-Jun	1650	25	8170	75.4	948	1050	0	19600	0	0	2440	0	2363	0	0	20650	102200	0	20650
6-Jun	1780	0	9950	75.4	976	2100	0	19600	0	0	2440	0	2363	0	0	21700	123900	0	21700
7-Jun	1660	0	11610	75.4	983	6300	0	0	10500	0	2440	0	2363	0	0	16800	140700	0	16800
8-Jun	1560	0	13170	75.4	952	3150	0	11200	1750	0	2440	0	2363	0	0	16100	156800	0	16100
9-Jun	1640	15	14810	90.4	1040	3150	0	16800	0	0	2440	0	2363	0	0	19950	176750	0	19950
10-Jun	1660	0	16470	90.4	977	4200	0	14000	0	0	2440	0	2363	0	0	18200	194950	0	18200
11-Jun	1700	20	18170	110.4	1061	2100	0	19600	0	8972	11412	8532	10895	0	0	21700	216650	17504	39204
12-Jun	1500	25	19670	135.4	1003	0	0	16800	0	1814	13226	1700	12595	0	0	16800	233450	3514	20314
13-Jun	1450	30	21120	165.4	1015	0	3150	0	14000	2068	15294	1892	14487	0	0	17150	250600	3960	21110
14-Jun	1800	0	22920	165.4	1006	0	7350	0	14000	316	15610	273	14760	0	0	21350	271950	589	21939
15-Jun	1830	0	24750	165.4	1058	0	4200	16800	0	618	16228	572	15332	0	0	21000	292950	1190	22190
16-Jun	1860	17	26610	182.4	1116	5250	0	16800	0	351	16579	330	15662	0	0	22050	315000	681	22731
17-Jun	1870	26	28480	208.4	1090	6300	0	14000	0	98	16677	93	15755	0	0	20300	335300	191	20491
18-Jun	1710	33	30190	241.4	1034	3150	0	16800	0	897	17574	810	16565	0	0	19950	355250	1707	21657
19-Jun	1510	0	31700	241.4	975	0	0	19600	0	990	18564	921	17486	0	0	19600	374850	1911	21511
20-Jun	1570	20	33270	261.4	921	0	0	16800	0	514	19078	475	17961	0	0	16800	391650	989	17789
21-Jun	1680	30	34950	291.4	862	5250	0	5600	8750	118	19196	124	18085	0	0	19600	411250	242	19842
22-Jun	1750	0	36700	291.4	996	9450	0	0	10500	20	19216	22	18107	0	0	19950	431200	42	19992
23-Jun	1640	10	38340	301.4	947	7350	0	0	12250	771	19987	691	18798	0	0	19600	450800	1462	21062
24-Jun	1480	0	39820	301.4	1000	4200	0	0	12250	2236	22223	2031	20829	0	0	16450	467250	4267	20717
25-Jun	1580	75	41400	376.4	948	3150	0	2800	12250	1528	23751	1402	22231	0	0	18200	485450	2930	21130
26-Jun	1540	0	42940	376.4	920	4200	2100	0	12250	1058	24809	996	23227	0	0	18550	504000	2054	20604
27-Jun	1620	0	44560	376.4	900	0	5250	0	14000	266	25075	247	23474	0	0	19250	523250	513	19763
28-Jun	1600	0	46160	376.4	945	0	0	19600	0	321	25396	292	23766	0	0	19600	542850	613	20213
29-Jun	1670	15	47830	391.4	930	0	1050	19600	0	620	26016	573	24339	0	0	20650	563500	1193	21843
30-Jun	1800	35.2	49630	426.6	600	4200	0	10500	0	233	26249	206	24545	0	0	14700	578200	439	15139
1-Jul	0	0	49630	426.6	0	0	0	0	0	0	26249	0	24545	0	0	0	578200	0	0

MONTHLY TOTAL KWH PRODUCED	628994
KWH PRODUCED PER GAL OF #2 DIESEL FUEL	11.65
DIESEL GENERATION PRODUCTION EFFICIENCY	29.02%
% WIND TURBINE KWH PRODUCED TO TOTAL GRID	8.08%
FUEL SAVINGS BY WIND TURBINE OPERATIONS IN GALLONS (AVOIDED GALLONS USED)	4360

AIR EMISSIONS AVOIDED BY WIND TURBINES IN POUNDS (TOTAL) CO2 =

CO2 =	97962	CO =	567	NOx =	2634	SO2 =	173
PM<10 =	185	TOC =	215	Aldehydes =	42		

June 12 – Wind turbines were transferred from “D” to “C” grid

San Clemente Island, CA
July 1999
Electrical Production, Fuel Use, and Emission Factors

	Fuel & Lube Oil Used							Diesel Generators				225kW Wind Turbines						Total Diesel		Tot. WT	Grid Load
	Daily		Total		Daily Pk Demand		Avg	500 KW	500 KW	1.2 MW	750 KW	225kW, WT-1		225kW, WT-2		225 KW, WT-3		KWH		KWH	Tot KWH
Date	Fuel	Lube	Fuel	Lube	Time	Load	PF	DE-1	DE-2	DE-3	DE-4	Daily	CUM	Daily	CUM	Daily	CUM	Daily	CUM	Daily	Daily
1-Jul	1750	0	1750	0.0	1000	956	94	1050	1050	19800	0	320	320	312	312	0	0	21700	21700	632	22332
2-Jul	1570	15	3320	15.0	900	828	94	0	0	16800	0	14	334	13	325	0	0	16800	38500	27	16827
3-Jul	1510	15	4830	30.0	2200	826	93	0	0	19800	0	366	700	201	526	0	0	19800	58100	567	20167
4-Jul	1450	15	6280	45.0	2300	852	95	0	0	16800	0	280	980	865	1391	0	0	16800	74900	1145	17945
5-Jul	1440	0	7720	45.0	600	851	94	0	0	16800	0	804	1784	735	2126	0	0	16800	91700	1539	18339
6-Jul	1460	20	9180	65.0	2300	850	93	0	0	16800	0	672	2456	600	2726	0	0	16800	108500	1272	18072
7-Jul	1790	20	10970	85.0	600	990	93	4200	0	16800	0	19	2475	9	2735	0	0	21000	129500	28	21028
8-Jul	1700	15	12670	100.0	2100	917	93	0	0	19800	0	27	2502	21	2756	0	0	19800	149100	58	19858
9-Jul	1510	0	14180	100.0	400	887	93	0	0	11200	7000	507	3009	451	3217	0	0	18200	167300	958	19158
10-Jul	1160	0	15340	100.0	700	749	93	0	1050	0	12250	1951	4960	1841	5058	0	0	13300	180600	3792	17092
11-Jul	1540	11	16880	111.0	2100	834	93	0	1050	0	17500	778	5736	705	5763	0	0	18550	199150	1481	20031
12-Jul	1660	22	18540	133.0	2100	933	93	0	6300	0	13250	240	5976	226	5989	0	0	18550	217700	468	19018
13-Jul	1710	0	20250	133.0	2000	905	93	0	7350	0	14000	392	6368	340	6329	0	0	21350	239050	732	22082
14-Jul	1730	50	21980	183.0	2100	976	93	3150	1050	14000	1750	421	6789	368	6697	0	0	19950	259000	789	20739
15-Jul	1670	30	23650	213.0	900	876	93	1050	0	16800	0	517	7306	470	7167	0	0	17850	276850	987	18837
16-Jul	1580	15.3	25230	228.3	800	1060	93	3150	0	16800	0	703	8009	718	7885	0	0	19950	296800	1501	21451
17-Jul	1430	0	26660	228.3	900	878	93	0	0	14000	0	1179	9268	1067	8952	0	0	14000	310800	2246	16246
18-Jul	1490	0	28150	228.3	545	960	93	0	0	19600	0	848	10114	780	9732	0	0	19600	330400	1626	21226
19-Jul	1320	20	29470	248.3	500	925	93	0	0	14000	0	1701	11815	1576	11308	0	0	14000	344400	3277	17277
20-Jul	1300	0	30770	248.3	700	885	83	0	0	11200	0	2883	14698	2789	14097	8888	8888	11200	355600	14640	25840
21-Jul	1250	0	32020	248.3	1300	1000	86	0	0	11200	1750	2882	17580	2702	16799	664	9532	12950	368550	8248	19198
22-Jul	1270	0	33290	248.3	610	1050	88	0	0	0	15750	2793	20473	2577	19376	315	9847	15750	384300	5685	21435
23-Jul	1020	34.3	34310	282.6	1600	910	87	0	0	0	10500	3333	23806	3089	22475	1898	11743	10500	394800	8328	18828
24-Jul	810	17.8	35120	300.2	600	840	78	0	1050	0	7000	4151	27957	4014	26489	3338	14081	8050	402850	10503	18553
25-Jul	1530	4.4	36650	304.6	410	910	92	0	4200	0	14000	562	28519	512	27001	338	14417	18200	421050	1410	19610
26-Jul	1360	0	38030	304.6	1200	910	90	0	2100	0	14000	1858	30377	1773	28774	1095	15512	16100	437150	4726	20826
27-Jul	1230	0	39230	304.6	2100	1050	89	0	1050	0	13250	2648	33025	2524	31298	2037	17549	13300	450450	7209	20509
28-Jul	1380	40	40610	344.6	1500	1052	81	0	3150	0	12250	2368	35391	2229	33527	2227	19776	15400	465850	6822	22222
29-Jul	1160	0	41770	344.6	900	1100	78	0	2100	0	12250	3053	38444	2896	36423	2860	22636	14350	480200	8809	23159
30-Jul	1250	0	43020	344.6	1200	943	79	0	3150	0	10500	2410	40854	2280	38703	2268	24904	13850	493850	6958	20808
31-Jul	870	0	43890	344.6	2300	892	77	0	0	0	8750	3794	44648	3858	42361	3567	28471	8750	502600	11019	19769
MONTHLY TOTAL KWH PRODUCED																					513619
KWH PRODUCED PER GAL OF #2 DIESEL FUEL																					11.40
DIESEL GENERATION PRODUCTION EFFICIENCY																					28.60%
% WIND TURBINE KWH PRODUCED TO TOTAL GRID																					22.40%
FUEL SAVINGS BY WIND TURBINE OPERATIONS IN GALLONS (AVOIDED GALLONS USED)																					10084
AIR EMISSIONS AVOIDED BY WIND TURBINES IN POUNDS (TOTAL)																					
					CO2 =	226585		CO =	1313		NOx =	6893		SO2 =	481						
					PM<10 =	428		TOC =	497		Aldehydes =	97									

Wind Turbine #3 placed in operation July 3, 1999 @ 10am. July 27th discovered that CT Ratio was set to 500:1 instead of 600:1

Spreadsheet has been corrected for ~40% additional energy production for Turbine #3 for July 3–27 due to a wrong CT Ratio

San Clemente Island, CA
August 1999
Electrical Production, Fuel Use, and Emission Factors

	Fuel & Lube Oil Used							Diesel Generators				225kW Wind Turbines						Total Diesel		Tot. WT	Grid Load
	Daily		Total		Daily Pk Demand		Avg	500 KW	500 KW	1.2 MW	750 KW	225kW_WT-1		225kW_WT-2		225 kW_WT-3		KWH		KWH	Tot. KWH
Date	Fuel	Lube	Fuel	Lube	Time	Load	PF	DE-1	DE-2	DE-3	DE-4	Daily	CUM	Daily	CUM	Daily	CUM	Daily	CUM	Daily	Daily
1-Aug	1130	15	1130	15.0	800	910	91	0	5250	0	12250	720	720	631	631	849	849	17500	17500	2000	19500
2-Aug	1630	0	2760	15.0	1600	913	91	0	6300	0	12250	614	1334	536	1167	574	1223	18550	36050	1724	20274
3-Aug	1860	30	4620	45.0	1900	1103	94	0	4200	19600	0	525	1859	459	1626	466	1689	23800	59850	1460	25260
4-Aug	1870	20	6490	65.0	1200	1187	94	0	6300	11200	7000	1075	2944	974	2600	961	2650	24500	84350	3010	27510
5-Aug	1580	0	8070	65.0	800	1006	94	0	4200	0	12250	1087	4031	1040	3640	1081	3731	16450	100800	3208	19658
6-Aug	1400	30	9470	95.0	2100	920	93	0	3150	0	14000	1270	5301	1203	4843	1183	4914	17150	117950	3658	20808
7-Aug	1120	0	10590	95.0	900	846	94	0	1050	0	10500	2230	7531	2117	6960	2103	7017	11550	129500	6450	18000
8-Aug	1160	20	11750	115.0	1500	735	93	0	1050	0	12250	3129	10660	2975	9935	2870	9887	13300	142800	8974	22274
9-Aug	1550	25	13300	140.0	800	1015	94	3150	0	8400	7000	1816	12476	1759	11694	1761	11648	19550	161350	5338	23888
10-Aug	1520	0	14820	140.0	700	992	94	1050	0	16800	0	1410	13886	1343	13037	1184	12832	17850	179200	3937	21787
11-Aug	1430	15	16250	155.0	700	849	88	0	0	16800	0	2207	16093	2089	15126	642	13474	16800	196000	4938	21738
12-Aug	1870	20	17820	175.0	1200	1007	92	0	1050	16800	0	1489	17582	1371	16497	969	13843	17850	213850	3029	20879
13-Aug	1840	0	19660	175.0	800	890	92	0	1050	19600	0	208	17790	190	16687	230	13873	20650	234500	620	21270
14-Aug	1520	15	21080	190.0	1100	798	93	0	0	11200	5250	110	17900	104	16791	272	14145	16450	250950	486	16936
15-Aug	1690	0	22770	190.0	1000	952	93	0	5250	0	14000	467	18367	416	17207	295	14440	19250	270200	1178	20428
16-Aug	1570	30	24340	220.0	800	959	92	0	4200	0	14000	1598	19963	1437	18644	419	14859	18200	288400	3452	21652
17-Aug	1240	0	25580	220.0	2000	931	89	0	1050	0	14000	3040	23003	2798	21442	679	15538	15050	303450	6517	21567
18-Aug	1250	10	26830	230.0	1800	1005	95	0	1050	0	14000	3741	26744	3589	25031	0	15538	15050	318500	7330	22380
19-Aug	1700	15	28530	245.0	1800	1097	94	0	6300	0	14000	1328	28072	1236	26267	0	15538	20300	338800	2564	22864
20-Aug	1880	0	30410	245.0	1800	1072	93	0	8400	0	14000	148	28220	141	26408	0	15538	22400	361200	288	22688
21-Aug	1810	20	32220	265.0	1400	950	95	0	0	19600	0	399	28619	389	26777	0	15538	19600	380800	788	20388
22-Aug	1800	0	33820	265.0	2100	893	94	0	0	19600	0	153	28772	157	26934	0	15538	19600	400400	310	19910
23-Aug	1570	30	35190	295.0	1900	910	93	0	0	19600	0	758	29530	680	27614	0	15538	19600	420000	1438	21038
24-Aug	1750	25	36940	320.0	2000	1225	94	2100	0	16800	0	1298	30828	784	28398	0	15538	18800	438800	2082	20882
25-Aug	2010	20	38950	340.0	1000	1215	93	6300	0	16800	0	1226	32054	1107	29505	0	15538	23100	462000	2332	25433
26-Aug	1760	0	40710	340.0	800	988	93	4200	0	16800	0	1336	33390	1207	30712	0	15538	21000	483000	2543	23543
27-Aug	1580	21	42290	361.0	800	939	93	2100	0	16800	0	1475	34865	1369	32081	0	15538	18900	501900	2844	21744
28-Aug	1450	20	43740	381.0	2100	828	93	0	0	16800	0	1267	36132	1143	33224	0	15538	16800	518700	2410	19210
29-Aug	1610	0	45350	381.0	1100	940	93	1050	0	16800	0	505	36637	459	33683	0	15538	17850	536550	964	18814
30-Aug	1610	20	46960	401.0	2400	1024	93	1050	0	19600	0	925	37562	848	34531	0	15538	20650	557200	1773	22423
31-Aug	1920	20	48880	421.0	1100	1044	96	9450	0	0	14000	304	37866	273	34804	0	15538	23450	580650	577	24027
MONTHLY TOTAL KWH PRODUCED																					608850
KWH PRODUCED PER GAL OF #2 DIESEL FUEL																					11.88
DIESEL GENERATION PRODUCTION EFFICIENCY																					29.54%
% WIND TURBINE KWH PRODUCED TO TOTAL GRID																					13.19%
FUEL SAVINGS BY WIND TURBINE OPERATIONS IN GALLONS (AVOIDED GALLONS USED)																					7425
AIR EMISSIONS AVOIDED BY WIND TURBINES IN POUNDS (TOTAL)									CO2 =	166842		CO =	966		NOx =	4480			SO2 =	295	
									PM<10 =	315		TOC =	366		Aldehydes =		71				
Aug_18 Wind Turbine #3 Generator developed short in 225-kW winds																					
Aug_11-17th Wind Turbine #3 operating on 40-kW windings. Inoperative Aug_17th, Aug_24th Scheduled maintenance																					

San Clemente Island, CA
September 1999
Electrical Production, Fuel Use, and Emission Factors

	Fuel & Lube Oil Used							Diesel Generators				225kW Wind Turbines						Total Diesel		Tot. WT	Grid Load
	Daily		Total		Daily Pk Demand		Avg	500 KW	500 KW	1.2 MW	750 KW	225kW_WT-1		225kW_WT-2		225 kW_WT-3		KWH		KWH	Tot. KWH
Date	Fuel	Lube	Fuel	Lube	Time	Load	PF	DE-1	DE-2	DE-3	DE-4	Daily	CUM	Daily	CUM	Daily	CUM	Daily	CUM	Daily	Daily
1-Sep	1690	0	1690	0.0	700	997	93	8400	0	0	12250	417	417	417	417	0	0	20650	20650	834	21484
2-Sep	1510	0	3200	0.0	2100	795	93	0	0	11200	5250	344	761	336	753	0	0	16450	37100	680	17130
3-Sep	1230	71	4430	71.0	1000	780	93	0	0	8400	5250	1515	2276	1459	2212	0	0	13650	50750	2974	16624
4-Sep	1310	0	5740	71.0	2100	735	93	0	0	0	15750	799	3075	739	2951	0	0	15750	66500	1538	17288
5-Sep	1600	0	7340	71.0	2100	915	93	0	0	14000	5250	228	3303	215	3166	0	0	19250	85750	443	19693
6-Sep	1620	0	8960	71.0	600	995	93	1050	0	16800	0	447	3750	407	3573	0	0	17850	103600	854	18704
7-Sep	1410	20	10370	91.0	1100	832	93	0	0	16800	0	1223	4973	1137	4710	0	0	16800	120400	2360	19160
8-Sep	1300	20	11670	111.0	2000	875	93	0	0	14000	0	3012	7985	2830	7510	0	0	14000	134400	5812	19812
9-Sep	1350	10	13020	121.0	1700	1149	87	0	0	14000	0	3476	11461	3291	10801	0	0	14000	148400	6767	20767
10-Sep	1250	31	14270	152.0	800	938	87	0	0	11200	3500	3188	14649	3063	13864	0	0	14700	163100	6251	20951
11-Sep	1470	0	15740	152.0	600	1083	88	2100	0	0	15750	1123	15772	980	14854	0	0	17850	180950	2113	19963
12-Sep	1320	0	17060	152.0	2000	906	88	0	0	0	15750	2181	17953	2074	16928	0	0	15750	196700	4255	20005
13-Sep	1250	0	18310	152.0	1400	945	85	0	0	8400	3500	3533	21486	3354	20282	0	0	11900	208600	6887	18787
14-Sep	1360	20	19670	172.0	1100	1018	87	0	0	16800	0	3064	24550	2921	23203	0	0	16800	225400	5985	22785
15-Sep	1910	11	21580	183.0	1200	1195	94	6300	0	8400	7000	144	24694	142	23346	0	0	21700	247100	286	21986
16-Sep	1800	13.2	23380	196.2	2000	955	94	8450	0	0	12250	34	24728	31	23376	0	0	21700	268800	65	21765
17-Sep	1710	0	25090	196.2	1100	950	94	8400	0	0	10500	218	24946	205	23581	0	0	18900	287700	423	19323
18-Sep	1670	8.8	26760	205.0	1100	880		5250	0	0	14000	7	24953	6	23587	0	0	19250	306950	13	19263
19-Sep	1500	202	28340	407.4	2200	830	92	0	0	14000	5250	122	25075	111	23698	0	0	19250	326200	233	19483
20-Sep	1630	0	29970	407.4	2000	1090	92	0	0	19600	0	605	25680	539	24237	0	0	19600	345800	1144	20744
21-Sep	1810	46.2	31780	453.6	1300	1080	93	5250	0	8400	7000	309	25989	356	24593	0	0	20650	366450	665	21315
22-Sep	1700	0	33480	453.6	1300	1035	90	7350	0	0	12250	1562	27551	1405	25998	0	0	19600	386050	2967	22567
23-Sep	1620	0	35100	453.6	600	997	88	3150	0	0	15750	1554	29105	1436	27434	0	0	18900	404950	2990	21890
24-Sep	1660	16	36760	469.6	400	940	88	8400	0	0	14000	907	30012	846	28280	0	0	22400	427350	1753	24153
25-Sep	1410	0	38170	469.6	2100	909	88	4200	0	0	12250	2032	32044	1952	30192	0	0	16450	443800	3944	20394
26-Sep	1500	0	39670	469.6	2100	933	92	1050	0	0	15750	884	32928	829	31021	0	0	18800	462600	1713	18513
27-Sep	1770	30	41440	499.6	1900	1048	94	8400	0	0	12250	10	32938	9	31030	0	0	20650	481250	19	20669
28-Sep	1780	0	43220	499.6	1900	1001	93	9450	0	0	12250	77	33015	95	31125	0	0	21700	502950	172	21872
29-Sep	1800	0	45020	499.6	1100	1084	94	8400	0	0	14000	652	33667	0	31125	0	0	22400	525350	652	23052
30-Sep	1730	15	46750	514.6	1200	1033	93	7350	0	0	14000	617	34284	1188	32313	0	0	21350	546700	1805	23155

MONTHLY TOTAL KWH PRODUCED						613297
KWH PRODUCED PER GAL OF #2 DIESEL FUEL						11.69
DIESEL GENERATION PRODUCTION EFFICIENCY						29.13%
% WIND TURBINE KWH PRODUCED TO TOTAL GRID						10.86%
FUEL SAVINGS BY WIND TURBINE OPERATIONS IN GALLONS (AVOIDED GALLONS USED)						5695
AIR EMISSIONS AVOIDED BY WIND TURBINES IN POUNDS (TOTAL)	CO2 = 127958	CO = 741	NOx = 3441	SO2 = 226		
	PM<10 = 242	TOC = 201	Aldehydes = 55			

San Clemente Island, CA
October 1999
Electrical Production, Fuel Use, and Emission Factors

	Fuel & Lube Oil Used							Diesel Generators					225kW Wind Turbines						Total Diesel		Tot. WT	Grid Load
	Daily		Total		Daily Pk Demand		Avg	500 KW	500 KW	1.2 MW	750 KW	225kW_WT-1		225kW_WT-2		225 kW_WT-3		KWH		KWH	Tot. KWH
Date	Fuel	Lube	Fuel	Lube	Time	Load	PF	DE-1	DE-2	DE-3	DE-4	Daily	CUM	Daily	CUM	Daily	CUM	Daily	CUM	Daily	Daily
1-Oct	1280	0	1280	0.0	1100	1100	94	4200	0	0	14000	1800	1800	1188	1188	0	0	18200	18200	2988	21188
2-Oct	1170	40	2450	40.0	700	948	93	2100	0	2800	21250	1591	3391	1470	2658	0	0	26150	44350	3061	29211
3-Oct	1395	0	3845	40.0	1800	905	90	0	0	16800	1750	1170	4561	1088	3746	0	0	19550	63900	2258	20808
4-Oct	1370	15	5215	55.0	1900	980	91	0	0	14000	0	2835	7396	2658	6404	0	0	14000	78900	5493	19493
5-Oct	1510	20	6725	75.0	1200	1040	93	0	0	16800	0	2369	9765	2209	8613	0	0	16800	93700	4578	21378
6-Oct	1350	26	8075	101.0	700	1096	88	0	0	16800	0	3954	13719	3913	12526	0	0	16800	110500	7867	24667
7-Oct	1590	0	9665	101.0	700	957	92	0	0	19600	0	352	14071	506	13032	0	0	19600	130100	858	20458
8-Oct	1630	20	11295	121.0	1000	904	92	0	0	17236	0	125	14196	311	13343	0	0	17236	147336	436	17672
9-Oct	1620	20	12915	141.0	1300	886	91	0	0	19600	0	183	14379	148	13491	0	0	19600	166936	331	19931
10-Oct	1590	20	14505	161.0	1800	932	91	0	0	19600	0	163	14542	137	13628	0	0	19600	186536	300	19900
11-Oct	1530	0	16035	161.0	1900	904	91	0	0	16800	0	513	15055	484	14112	0	0	16800	203336	997	17797
12-Oct	1610	15	17645	176.0	1800	1009	90	2100	0	16800	0	1238	16293	1548	15660	0	0	18900	222236	2786	21686
13-Oct	1510	15	19155	191.0	1100	1075	93	1050	0	16800	0	1971	18264	1791	17451	0	0	17850	240086	3762	21612
14-Oct	1400	0	20555	191.0	1900	1033	94	0	0	8400	5250	3356	21620	3207	20658	0	0	13650	253736	6563	20213
15-Oct	1400	20	21955	211.0	700	921	93	4200	7350	0	7000	687	22307	695	21323	0	0	18550	272286	1352	19902
16-Oct	1520	0	23475	211.0	1200	880	92	9450	9450	0	0	64	22371	80	21383	0	0	18900	291186	124	19024
17-Oct	1490	0	24965	211.0	1900	901	93	8400	8400	0	0	430	22801	393	21776	0	0	16800	307986	823	17623
18-Oct	1590	30	26555	241.0	2000	931	95	10500	10500	0	0	473	23274	487	22263	0	0	21000	328986	960	21960
19-Oct	1700	25	28255	266.0	800	1015	93	10500	10500	0	0	201	23475	226	22489	0	0	21000	349986	427	21427
20-Oct	1630	10	29885	276.0	1900	1043	91	8400	8400	5600	0	258	23733	281	22770	0	0	22400	372386	539	22939
21-Oct	1760	10	31645	286.0	1100	1007	91	5250	0	16800	0	463	24196	425	23195	400	400	22050	394436	1288	23338
22-Oct	1710	0	33355	286.0	700	1086	92	1050	0	16800	0	175	24371	187	23382	213	613	17850	412286	575	18425
23-Oct	1640	10	34995	296.0	1300	1013	92	1050	0	16800	0	110	24481	119	23501	129	742	17850	430136	358	18208
24-Oct	1470	15	36465	311.0	1800	875	88	8400	9450	0	0	429	24910	678	24179	697	1439	17850	447986	1804	19654
25-Oct	1510	10	37975	321.0	1900	937	88	9450	9450	0	0	814	25724	839	25018	844	2283	18900	466886	2497	21397
26-Oct	1400	15	39375	336.0	1900	1065	88	8400	8400	0	0	1378	27102	1290	26308	1283	3566	16800	483686	3951	20751
27-Oct	1620	0	40995	336.0	1100	1025	93	3150	6250	14000	0	1121	28223	1029	27337	1001	4567	22400	506086	3151	25551
28-Oct	1430	0	42425	336.0	700	940	93	0	0	14000	0	1822	30045	1789	29126	1762	6329	14000	520086	5372	19372
29-Oct	1650	0	44075	336.0	700	954	93	1050	0	19600	0	131	30176	127	29252	113	6442	20650	540736	371	21021
30-Oct	1530	10	45605	346.0	900	901	93	0	0	19600	0	472	30648	578	29830	568	7010	19600	560336	1618	21218
31-Oct	1680	55	47285	401.0	1300	888	93	3150	4200	11200	0	169	30817	187	29997	171	7181	18550	578886	507	19057
MONTHLY TOTAL KWH PRODUCED																						646881
KWH PRODUCED PER GAL OF #2 DIESEL FUEL																						12.24
DIESEL GENERATION PRODUCTION EFFICIENCY																						30.58%
% WIND TURBINE KWH PRODUCED TO TOTAL GRID																						10.51%
FUEL SAVINGS BY WIND TURBINE OPERATIONS IN GALLONS (AVOIDED GALLONS USED)																						5554
AIR EMISSIONS AVOIDED BY WIND TURBINES IN POUNDS (TOTAL)										CO2 =	124792		CO =	723		NOx =	3350		SO2 =	221	
										PM<10 =	236		TOC =	274		Aldehydes =		53			

WTG #3 was placed back in operation @ 1600 hours on 10/21/99 (WP2060 Soft cut-in circuit board replaced)

San Clemente Island, CA
November 1999
Electrical Production, Fuel Use, and Emission Factors

	Fuel & Lube Oil Used							Diesel Generation				225kW Wind Turbines						Total Diesel		Tot. WT	Grid Load
	Daily		Total		Daily Pk Demand		Avg	500 kW	500 kW	1.2 MW	750 kW	225kW_ WTG-1		225kW_ WTG-2		225 kW_ WTG-3		KWH		KWH	Tot KWH
Date	Fuel	Lube	Fuel	Lube	Time	Load	PF	DE-1	DE-2	DE-3	DE-4	Daily	CUM	Daily	CUM	Daily	CUM	Daily	CUM	Daily	Daily
1-Nov	1680	0	1680	0.0	1800	982	93	10500	10500	0	0	27	27	31	31	29	29	21000	21000	87	21087
2-Nov	1410	0	3090	0.0	1800	962	93	2100	6300	0	10500	380	407	345	376	362	391	18900	39900	1087	19987
3-Nov	1120	0	4210	0.0	2000	962	88	0	4200	0	12250	2031	2438	1895	2271	1874	2265	16450	56350	5800	22250
4-Nov	1440	30	5650	30.0	700	973	93	0	7350	0	12250	103	2541	94	2365	93	2359	19600	75950	290	19890
5-Nov	1400	0	7050	30.0	700	953	93	0	8400	0	12250	13	2554	12	2377	11	2369	20650	96600	38	20688
6-Nov	1340	25	8390	55.0	600	854	93	0	8400	0	10500	49	2603	58	2435	52	2401	18900	115500	139	19039
7-Nov	1380	0	9770	55.0	900	872	92	0	8400	0	10500	295	2898	325	2760	338	2739	18900	134400	958	19858
8-Nov	1040	0	10810	55.0	1200	974	90	0	1050	0	14000	1454	4352	1514	4274	1540	4279	15050	149450	4509	19559
9-Nov	1180	30	11980	85.0	1900	1018	90	0	3150	0	12250	1362	5714	1252	5526	1246	5525	15400	164850	3860	19260
10-Nov	1270	0	13260	85.0	600	1000	91	0	4200	0	14000	793	6507	718	6244	717	6242	18200	183050	2228	20428
11-Nov	1570	30.8	14830	115.8	600	955	92	0	2100	14000	4200	77	6584	71	6315	78	6320	20300	203350	226	20526
12-Nov	1700	24.2	16530	140.0	1700	1040	94	1050	0	19600	0	118	6702	108	6423	111	6431	20650	224000	337	20987
13-Nov	1680	0	18210	140.0	1700	1035	94	0	0	19600	0	435	7137	403	6826	405	6836	19600	243600	1243	20843
14-Nov	1620	17.6	19830	157.6	2200	970	94	0	0	19600	0	486	7623	442	7268	436	7272	19600	263200	1364	20964
15-Nov	1730	2.4	21560	160.0	1900	1205	94	3150	0	16800	0	573	8196	508	7774	522	7794	19950	283150	1601	21551
16-Nov	1720	41.6	23280	201.6	1800	1160	94	3150	0	16800	0	1105	9301	860	8634	930	8724	19950	303100	2895	22845
17-Nov	1320	0	24600	201.6	1800	1102	83	0	0	14000	0	3266	12567	3144	11778	3186	11830	14000	317100	9516	23516
18-Nov	1680	30	26280	231.6	800	1105	93	7350	0	16800	0	1197	13764	1105	12883	1101	12931	24150	341250	3403	27553
19-Nov	1890	20	28170	251.6	700	1060	94	6300	0	16800	0	292	14046	263	13246	0	12931	23100	364350	545	23645
20-Nov	1310	0	29480	251.6	700	1020	89	1100	0	5600	7000	1927	15973	1832	15178	1864	14795	13700	378050	5723	19423
21-Nov	1058	0	30538	251.6	900	1087	79	0	0	0	10500	2881	18854	2385	18563	2395	18190	10500	388550	9661	20161
22-Nov	1290	20	31828	271.6	1800	1088	94	0	7350	0	12250	1086	19920	1175	18738	1127	19317	19600	408150	3368	22868
23-Nov	1520	0	33348	271.6	900	1092	95	6300	2100	0	12250	615	20535	548	20284	558	19875	20650	428800	1719	22369
24-Nov	1530	0	34878	271.6	800	972	94	9450	0	0	14000	89	20624	143	20427	177	20052	23450	452250	409	23859
25-Nov	1430	0	36308	271.6	2000	960	94	7350	0	0	12250	168	20792	188	20615	184	20236	19600	471850	540	20140
26-Nov	1350	15	37658	286.6	1900	850	93	5250	0	0	12250	377	21169	398	21013	424	20660	17500	489350	1199	18699
27-Nov	1390	20	39048	306.6	700	952	93	2100	6300	0	12250	288	21457	303	21316	294	20954	20650	510000	885	21535
28-Nov	1470	20	40518	326.6	1700	915	93	0	9450	0	12250	59	21516	49	21365	55	21009	21700	531700	163	21863
29-Nov	1490	0	42008	326.6	1700	1170	94	0	8400	0	12250	449	21965	393	21758	377	21386	20650	552350	1219	21869
30-Nov	1220	30	43228	356.6	1800	1220	93	0	5250	0	12250	2352	24317	2194	23952	2174	23560	17500	589850	6720	24220
1-Dec	0	0	43228	356.6	0	0	0	0	0	0	0	0	24317	0	23952	0	23560	0	589850	0	0

MONTHLY TOTAL KWH PRODUCED	641670
KWH PRODUCED PER GAL OF #2 DIESEL FUEL	13.18
DIESEL GENERATION PRODUCTION EFFICIENCY	32.84%
% WIND TURBINE KWH PRODUCED TO TOTAL GRID	11.19%
FUEL SAVINGS BY WIND TURBINE OPERATIONS IN GALLONS (AVOIDED GALLONS USED)	5449

AIR EMISSIONS AVOIDED BY WIND TURBINES IN POUNDS (TOTAL)

CO2 =	64484	CO =	709	NOx =	3292	SO2 =	216		
PM<10 =	231	TOC =	269	Aldehydes =	52				

San Clemente Island, CA
December 1999
Electrical Production, Fuel Use, and Emission Factors

	Fuel & Lube Oil Used							Diesel Generators				225kW Wind Turbines						Total Diesel		Tot. WT	Grid Load
	Daily		Total		Daily Pk Demand		Avg	500 KW	500 KW	1.2 MW	750 KW	225kW_WT-1		225kW_WT-2		225 kW_WT-3		KWH		KWH	Tot. KWH
Date	Fuel	Lube	Fuel	Lube	Time	Load	PF	DE-1	DE-2	DE-3	DE-4	Daily	CUM	Daily	CUM	Daily	CUM	Daily	CUM	Daily	Daily
1-Dec	1300	13.2	1300	13.2	1400	1220	90	0	6300	0	10500	2098	2098	2255	2255	2235	2235	18800	18800	6588	23388
2-Dec	1570	40	2870	53.2	1746	1133	95	0	9450	0	12250	941	3039	877	3132	866	3101	21700	38500	2684	24384
3-Dec	1690	0	4560	53.2	457	1125	95	3150	4200	8400	8750	883	3922	931	4063	926	4027	24500	63000	2740	27240
4-Dec	1770	20	6330	73.2	533	1088	94	3150	0	16800	0	173	4095	195	4258	219	4246	19950	82950	587	20537
5-Dec	1710	25	8040	98.2	559	1059	94	2100	0	19600	0	246	4341	216	4474	246	4492	21700	104650	708	22408
6-Dec	1880	0	9920	98.2	1903	1199	89	0	6300	14000	0	319	4660	272	4746	273	4765	20300	124950	884	21184
7-Dec	1520	0	11440	98.2	831	1248	78	0	3150	14000	0	2540	7200	2623	7369	2547	7312	17150	142100	7710	24860
8-Dec	1750	0	13190	98.2	800	1205	76	0	7350	2800	12250	519	7719	486	7855	844	7856	22400	164500	1649	24049
9-Dec	1830	0	14820	98.2	2000	1239	93	8450	0	0	12250	896	8615	842	8697	954	8810	21700	186200	2592	24292
10-Dec	860	15	15680	113.2	800	1395	94	1050	0	0	12250	3248	11861	3939	12608	3854	12664	13300	199500	11009	24309
11-Dec	1670	25	17350	138.2	656	1200	93	2100	1050	16800	0	255	12116	446	13052	471	13135	19950	219450	1172	21122
12-Dec	1670	10	19020	148.2	700	910	94	2100	0	19600	0	190	12306	190	13242	164	13299	21700	241150	544	22244
13-Dec	1850	10	20870	158.2	2000	1150	93	0	2100	22400	0	1545	13851	1432	14674	1469	14768	24500	265650	4446	28946
14-Dec	2020	30	22890	188.2	800	1152	93	7350	0	14000	0	256	14107	257	14931	259	15027	21350	287000	772	22122
15-Dec	1890	20	24580	208.2	921	1199	93	6300	0	16800	0	500	14607	592	15523	618	15645	23100	310100	1710	24810
16-Dec	2110	0	26690	208.2	1125	1192	95	8400	0	16800	0	53	14660	86	15609	85	15730	25200	335300	204	25404
17-Dec	1840	25	28530	233.2	820	1011	95	4200	0	16800	0	128	14788	125	15714	103	15833	21000	356300	356	21356
18-Dec	1570	15	30100	248.2	854	938	94	0	0	19600	0	329	15117	293	16007	295	16128	19600	375900	917	20517
19-Dec	1590	0	31690	248.2	1714	837	94	0	0	19600	0	78	15193	94	16101	94	16222	19600	395500	264	19864
20-Dec	1580	0	33270	248.2	1331	946	94	0	0	16800	0	389	15582	371	16472	366	16588	16800	412300	1126	17926
21-Dec	1700	50	34970	298.2	733	1096	92	2100	0	16800	0	364	15946	367	16839	402	16990	18900	431200	1133	20033
22-Dec	1380	9	36350	307.2	800	935	89	0	0	16800	0	1427	17373	1417	18256	1361	18351	16800	448000	4205	21005
23-Dec	1510	12	37860	319.2	700	930	92	3150	3150	11200	0	289	17661	313	18569	308	18659	17500	465500	909	18409
24-Dec	1460	7.8	39320	327.0	800	835	92	7350	7350	2800	0	253	17914	293	18862	288	18947	17500	483000	834	18334
25-Dec	1530	17.6	40850	344.6	800	825	92	9450	9450	0	0	0	17914	0	18862	0	18947	17850	500850	0	17850
26-Dec	1530	0	42380	344.6	1900	970	92	9450	9450	0	0	41	17955	35	18897	39	18986	18900	519750	115	19015
27-Dec	1550	8.8	43930	353.4	1900	890	92	4200	4200	11200	0	51	18006	61	18958	54	19040	19600	539350	166	19766
28-Dec	1560	39.6	45490	393.0	800	990	92	1050	1050	11200	2500	191	18197	216	19174	252	19292	16800	556150	649	17449
29-Dec	1370	20	46860	413.0	2100	857	93	0	5250	2800	10500	82	18269	57	19231	60	19352	18550	574700	199	18749
30-Dec	1570	20	48430	433.0	1200	912	93	0	0	19600	0	872	19241	880	20111	859	20211	19600	594300	2711	22311
31-Dec	1460	20	49890	453.0	700	914	94	0	0	16800	0	665	19906	641	20752	644	20855	16800	611100	1950	18750
MONTHLY TOTAL KWH PRODUCED																					672613
KWH PRODUCED PER GAL OF #2 DIESEL FUEL																					12.25
DIESEL GENERATION PRODUCTION EFFICIENCY																					38.52%
% WIND TURBINE KWH PRODUCED TO TOTAL GRID																					9.15%
FUEL SAVINGS BY WIND TURBINE OPERATIONS IN GALLONS (AVOIDED GALLONS USED)																					5622
AIR EMISSIONS AVOIDED BY WIND TURBINES IN POUNDS (TOTAL)										CO2 =	112836		CO =	654		NOx =	3834		SO2 =	208	
										PM<10 =	213		TOC =	248		Aldehydes =	48				

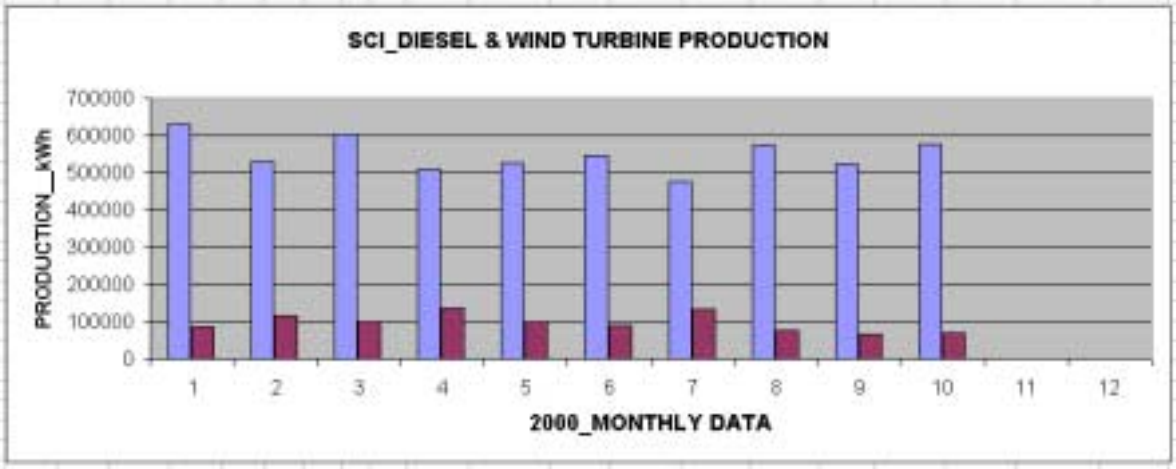
December 29 – 10:20 to ~ noon – “D” line down. Cause unknown

San Clemente Island, CA
2000 Electrical Production and Emission Savings

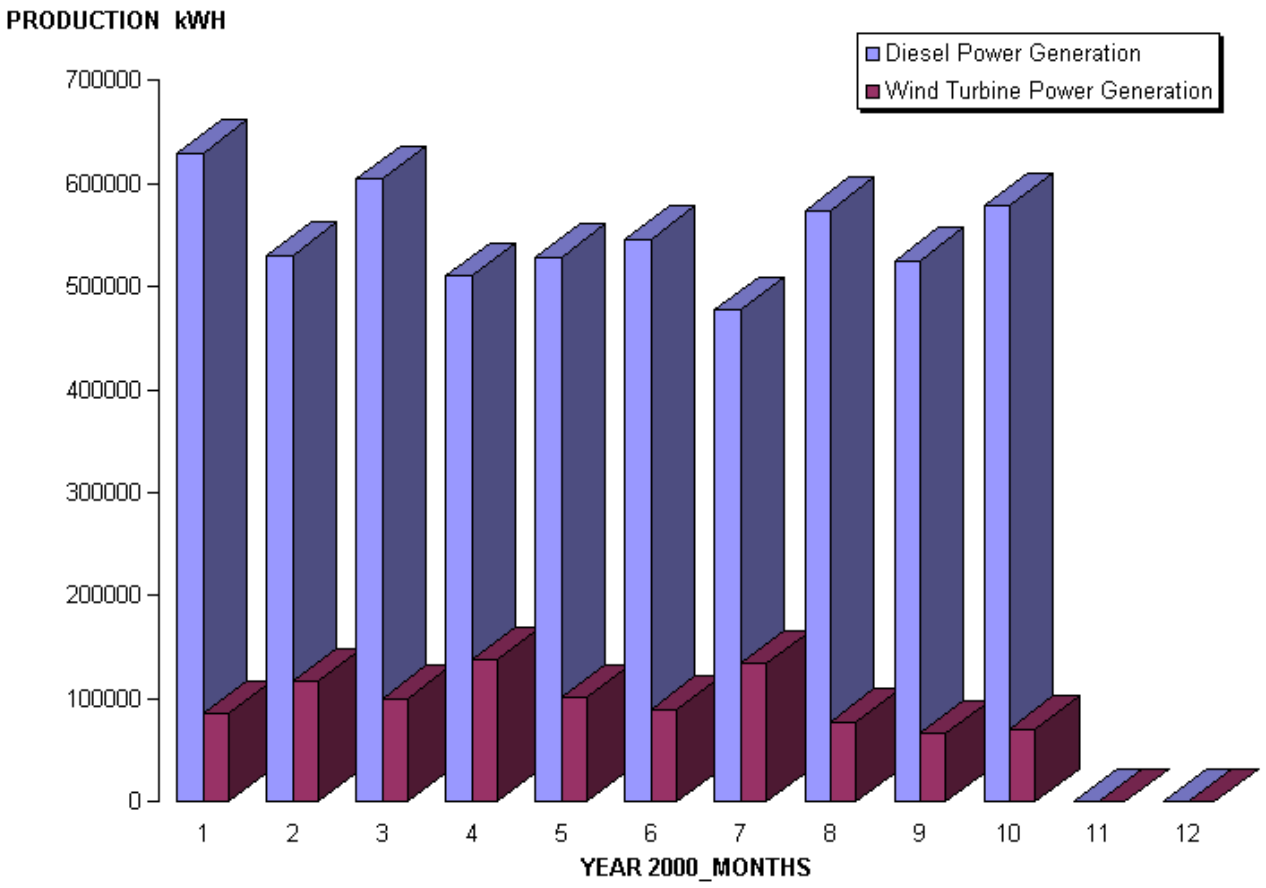
	Fuel & Lube Oil Used											225kW Wind Turbines						Total Diesel		Tot. WT	Grid Load
	Daily		Total									225kW_WT-1		225kW_WT-2		225 kW_WT-3		kWH		kWH	Tot. kWH
Date	Fuel	Lube	Fuel	Lube								Monthly	CUM	Monthly	CUM	Monthly	CUM	Monthly	CUM	Monthly	Monthly
JAN_00	51195	426.0	51195	426.0	0	0	0	0	0	0	0	28307	28307	28343	28343	28894	28894	628050	628050	85544	714594
FEB_00	40460	367	40460	367.0	0	0	0	0	0	0	0	40694	69001	39303	67646	37055	65949	530400	1158450	117052	647452
MAR_00	48900	641.8	48900	641.8	0	0	0	0	0	0	0	34987	103988	33329	100975	32071	98020	603750	1763200	100387	704137
APR_00	41920	355.4	41920	355.4	0	0	0	0	0	0	0	48780	152768	43462	144437	45537	143557	510300	2273500	137779	648079
MAY_00	43570	333.8	43570	333.8	0	0	0	0	0	0	0	34795	187563	33506	177943	32967	176524	528150	2801650	101268	629418
JUN_00	45410	344.7	45410	344.7	0	0	0	0	0	0	0	31514	219077	29584	207527	28172	205696	545650	3347300	90250	635903
JUL_00	35580	287	35580	287.0	0	0	0	0	0	0	0	47408	266483	44019	251546	43229	248925	477050	3824350	134694	611744
AUG_00	42400	469.9	42400	469.9	0	0	0	0	0	0	0	27409	293892	25437	277003	24895	273820	573740	4398090	77741	651481
SEP_00	39300	599.6	39300	599.6	0	0	0	0	0	0	0	23389	317281	21776	298779	21404	295224	525000	4923090	66579	591579
OCT_00	44500	367.7	44500	367.7	0	0	0	0	0	0	0	24121	341412	23347	322126	23101	318325	577850	5500940	70569	648419
NOV_00	0	0	0	0.0	0	0	0	0	0	0	0	0	341412	0	322126	0	318325	0	5500940	0	0
DEC_00	0	0.0	0	0.0	0	0	0	0	0	0	0	0	341412	0	322126	0	318325	0	5500940	0	0
			433175										341412		322126		318325		0		

MONTHLY TOTAL KWH PRODUCED	6492803
KWH PRODUCED PER GAL OF #2 DIESEL FUEL	12.70
DIESEL GENERATION PRODUCTION EFFICIENCY	31.68%
% WIND TURBINE KWH PRODUCED TO TOTAL GRID	15.15%
FUEL SAVINGS BY WIND TURBINE OPERATIONS IN GALLONS (AVOIDED GALLONS USED)	77357

AIR EMISSIONS AVOIDED BY WIND TURBINES IN POUNDS (TOTAL)											
	CO2 =	1737232	CO =	10063	NOx =	46715	SO4 =	3872			
	PM-10 =	3284	TOC =	3813	Aldehydes =	742					



SCI DIESEL & WIND TURBINE PRODUCTION



San Clemente Island, CA
January 2000
Electrical Production, Fuel Use, and Emission Factors

	Fuel & Lube Oil Used							Diesel Generators				225kW Wind Turbines						Total Diesel		Tot. WT	Grid Load
	Daily		Total		Daily Pk Demand		Avg	500 KW	500 KW	1.2 MW	750 KW	225kW_WT-1		225kW_WT-2		225 kW_WT-3		KWH		KWH	Tot. KWH
Date	Fuel	Lube	Fuel	Lube	Time	Load	PF	DE-1	DE-2	DE-3	DE-4	Daily	CUM	Daily	CUM	Daily	CUM	Daily	CUM	Daily	Daily
1-Jan	1320	0	1320	0.0	700	901	95	0	0	11200	0	2925	2925	2913	2913	2927	2927	11200	11200	8585	19785
2-Jan	1070	0	2390	0.0	900	922	92	0	0	8400	0	3526	6451	3677	6590	3397	6224	8400	19600	10500	18900
3-Jan	2640	20	5030	20.0	1110	1190	95	0	5250	16800	0	208	6657	195	6585	196	6420	22050	41650	597	22647
4-Jan	2095	20	7125	40.0	630	1097	98	0	5350	14000	0	668	7323	617	7202	626	7046	19350	61000	1909	21259
5-Jan	1540	0	8665	40.0	1821	1135	92	0	7350	14000	0	515	7838	727	7929	855	7901	21350	82350	2097	23447
6-Jan	1540	28.2	10205	68.2	715	1175	98	6300	0	5600	5250	819	8657	943	8872	951	8852	17150	99500	2713	19863
7-Jan	1510	41.8	11715	110.0	730	1120	92	3150	4200	0	14000	668	9323	601	9473	594	9446	21350	120850	1861	23211
8-Jan	1820	15.5	13535	125.5	1730	1115	91	6300	3150	0	14000	151	9474	144	9617	145	9591	23450	144300	440	23890
9-Jan	1520	0	15055	125.5	845	1035	94	0	8400	0	10500	283	9757	250	9867	246	9837	18900	163200	779	19679
10-Jan	1510	0	16565	125.5	1740	1220	94	0	9450	0	14000	1348	11105	1231	11098	1245	11082	23450	186650	3824	27274
11-Jan	1500	33	18065	158.5	722	1315	93	0	7350	0	12250	2007	13112	1873	12971	1819	12901	19600	206250	5699	25299
12-Jan	1770	10	19835	168.5	901	1333	93	0	10500	0	15750	697	13809	685	13636	648	13549	26250	232500	2010	28260
13-Jan	1560	0	21395	168.5	718	1269	98	0	9450	0	12250	424	14233	644	14280	681	14240	21700	254200	1759	23459
14-Jan	1400	10	22795	178.5	725	1079	94	0	8400	0	10500	347	14580	410	14690	577	14817	18900	273100	1334	20234
15-Jan	1430	29.2	24225	207.7	1732	968	93	0	3150	11200	7000	304	14884	282	14972	329	15146	21350	294450	915	22265
16-Jan	1870	0	25695	207.7	1730	1201	98	3150	0	16800	0	398	15282	417	15389	418	15564	19950	314400	1233	21183
17-Jan	1840	0	27535	207.7	852	1144	96	9450	0	14000	0	83	15365	117	15506	127	15691	23450	337850	327	23777
18-Jan	1870	20	29505	227.7	1900	1088	91	5250	0	14000	0	444	15809	498	16004	948	16639	19250	357100	1890	21140
19-Jan	1500	0	31005	227.7	1300	1081	92	4200	0	14000	0	1305	17114	1303	17307	1333	17972	18200	375300	3941	22141
20-Jan	1650	0	32735	227.7	1800	1155	92	5250	0	14000	0	1201	18315	1130	18437	1100	19072	19250	394550	3431	22681
21-Jan	1230	55	33965	282.7	700	1117	92	1050	0	11200	5250	2174	20489	2056	20493	2078	21150	17500	412050	6308	23808
22-Jan	1540	0	35505	282.7	700	1015	91	7350	8400	0	8750	398	20888	388	20881	374	21524	24500	436550	1141	25641
23-Jan	1800	20	37105	302.7	600	990	93	4200	8400	0	7000	188	21076	185	21046	205	21729	19600	456150	578	20178
24-Jan	1590	0	38695	302.7	1800	1030	92	2100	8400	0	12250	218	21292	212	21258	222	21951	22750	478900	650	23400
25-Jan	1800	15	40495	317.7	1800	1308	98	0	8400	8400	5250	713	22005	772	22030	822	22773	22050	500950	2307	24357
26-Jan	1540	20.3	42035	338.0	1724	1313	92	4200	0	14000	0	3014	25019	3024	25034	2809	25582	18200	519150	8827	27027
27-Jan	2040	35	44075	373.0	718	1265	98	9450	0	16800	0	162	25181	142	25176	127	25709	26250	545400	431	26681
28-Jan	1890	0	46065	373.0	559	1212	91	7350	0	14000	0	133	25314	125	25301	124	25833	21350	566750	982	21732
29-Jan	1860	20	47925	393.0	508	1105	91	6300	0	16800	0	264	25578	255	25556	238	26071	23100	589850	757	23857
30-Jan	1730	0	49655	393.0	619	1056	91	5250	0	14000	0	835	26413	844	26400	858	26929	19250	609100	2537	21787
31-Jan	1540	33	51195	426.0	1802	1224	98	3150	0	16800	0	1894	28307	1943	28343	1965	28894	19950	629050	5802	25752
MONTH TOTAL			51195	426.0									28307		28343		28894		629050		714594
KWH PRODUCED PER GAL OF #2 DIESEL FUEL																					12.29
DIESEL GENERATION PRODUCTION EFFICIENCY																					38.61%
% WIND TURBINE KWH PRODUCED TO TOTAL GRID																					11.97%
FUEL SAVINGS BY WIND TURBINE OPERATIONS IN GALLONS (AVOIDED GALLONS USED)																					6962
AIR EMISSIONS AVOIDED BY WIND TURBINES IN POUNDS												CO2 =	156427		CO =	806		NOx =	4286	SO2 =	277
												PM<10 =	296		TOC =	343		Aldehydes =	67		

January 18–19 – WPMS turbine data used – SCADA system down

San Clemente Island, CA
February 2000
Electrical Production, Fuel Use, and Emission Factors

	Fuel & Lube Oil Used							Diesel Generators				225kW Wind Turbines						Total Diesel		Tot. WT	Grid Load
	Daily		Total															KWH		KWH	Tot. KWH
Date	Fuel	Lube	Fuel	Lube	Daily Pk Demand Time	Load	Avg PF	500 KW DE-1	500 KW DE-2	1.2 MW DE-3	750 KW DE-4	225kW_WT-1 Daily	CUM	225kW_WT-2 Daily	CUM	225kW_WT-3 Daily	CUM	Daily	CUM	Daily	Daily
1-Feb	2010		2010	0.0	700	1252	93	8400		14000		172	172	174	174	199	199	22400	22400	545	22945
2-Feb	1540	25	3550	25.0	2018	1298	94	3150		14000		2132	2304	2026	2180	2014	2213	17150	39550	6152	23302
3-Feb	1760	15	5310	40.0	1111	1228	95	4200		16800		581	2885	677	2857	696	2909	21000	60550	1914	22914
4-Feb	1830	29	6940	69.0	817	1202	94	6300		16800		123	2968	106	2963	100	3009	23100	83650	329	23429
5-Feb	1170	0	8110	69.0	2200	1113	93	7350			12250	454	3422	430	3393	432	3441	19600	103250	1316	20916
6-Feb	980	0	9090	69.0	1917	1160	94		6300		12250	667	4089	658	4051	644	4085	18550	121800	1969	20519
7-Feb	1810	30	10700	99.0	1755	1280	93		9450		14000	148	4228	137	4188	165	4250	23450	145250	442	23892
8-Feb	1590	0	12290	99.0	700	1040	93		7350		14000	657	4886	637	4825	654	4904	21350	166600	1948	23298
9-Feb	1560	35	13850	134.0	1200	1078	94		7350		15750	984	5870	934	5759	908	5812	23100	189700	2836	25936
10-Feb	1190	0	15040	134.0	630	1127	93		4200		12250	2054	7934	2014	7773	1989	7801	18450	208150	6057	23507
11-Feb	1490	0	16530	134.0	1800	1100	96		7350		14000	792	8726	820	8593	779	8580	21350	227500	2391	23741
12-Feb	1220	35	17750	169.0	600	1126	95		5250		10500	1824	10550	1700	10293	1707	10287	15750	243250	5231	20981
13-Feb	1340	0	19090	169.0	800	1011	93		7350		12250	1308	11858	1384	11597	1276	11563	19600	262850	3888	23488
14-Feb	1590	10	20680	179.0	1800	1110	95		8400		14000	412	12268	400	11997	391	11954	22400	285250	1203	23603
15-Feb	1680	0	22360	179.0	1900	1008	96		8400	2800	8750	273	12541	294	12291	283	12237	19950	305200	850	20800
16-Feb	1240	28	23600	207.0	700	1107	94		5250		12250	2751	15292	2751	15042	2082	14319	17500	322700	7584	25084
17-Feb	1150	35	24750	242.0	2300	930	94	2100	2100	5600	8750	3055	18347	2886	17708	2254	16573	18550	341250	7975	26525
18-Feb	1720	55	26470	297.0	700	978	93	4200		14000		120	18467	124	17832	121	16694	18200	359450	365	18565
19-Feb	1200	0	27750	297.0	1200	849	93			16800		1890	20157	1548	19381	1664	18358	16800	376250	4903	21703
20-Feb	770		28520	297.0	600	811	93			2800	5250	3588	23737	3305	22686	3031	21389	8050	384300	9916	17966
21-Feb	920		29440	297.0	2000	855	93			5600	8750	2603	26340	2584	25270	2001	23390	14350	398650	7188	21538
22-Feb	1680		31120	297.0	800	1259	95	3150		16800		298	26638	286	25556	309	23699	19950	418600	901	20851
23-Feb	1340	20	32460	317.0	805	1127	84	2100		14000		3352	29988	3286	28842	3142	26841	16100	434700	9760	25860
24-Feb	1100	10	33560	327.0	2300	939	78			11200		4055	34043	3956	32798	3815	30656	11200	445900	11826	23026
25-Feb	1840	20	35400	347.0	2017	971	95	6300		13800		218	34261	212	33010	254	30910	20100	466000	678	20778
26-Feb	1660		37060	347.0	637	1002	96			19600		14	34267	35	33035	0	30910	19600	485600	49	19649
27-Feb	1140	10	38200	357.0	649	962	96			8400	1750	2169	36435	2101	35136	2045	32955	10150	495750	6314	16464
28-Feb	870	0	39070	357.0	2113	1008	81		2100		12250	2862	39297	2902	38039	2925	35780	14350	510100	6690	21040
29-Feb	1420	10	40490	367.0	843	1175	94		6300		14000	1297	40594	1284	39323	1275	37055	20300	530400	3838	24138
MONTH TOTAL			40490	367.0									40594		39323		37055		530400		647452
KWH PRODUCED PER GAL OF #2 DIESEL FUEL																					13.10
DIESEL GENERATION PRODUCTION EFFICIENCY																					32.63%
% WIND TURBINE KWH PRODUCED TO TOTAL GRID																					18.08%
FUEL SAVINGS BY WIND TURBINE OPERATIONS IN GALLONS (AVOIDED GALLONS USED)																					1836
AIR EMISSIONS AVOIDED BY WIND TURBINES IN POUNDS												CO2 =	208772		CO =	1163		NOx =	6380	SO2 =	355
												PM<10 =	380		TOC =	441		Aldehydes =	86		

February 15, 16, 17 – enXco scheduled maintenance outages [~2,000-kWh lost production]
February 20 – "D" grid outage: high winds [~1,750 kWh lost production]
February 21 – "D" line switching high winds. WT #3 shut down [~200 kWh lost production]

San Clemente Island, CA
March 2000
Electrical Production, Fuel Use, and Emission Factors

	Fuel & Lube Oil Used							Diesel Generators				225kW Wind Turbines						Total Diesel		Tot. WT	Grid Load
	Daily		Total		Daily Pk Demand		Avg	500 KW	500 KW	1.2 MW	750 KW	225kW_WT-1		225kW_WT-2		225 kW_WT-3		KWH		KWH	Tot. KWH
Date	Fuel	Lube	Fuel	Lube	Time	Load	PF	DE-1	DE-2	DE-3	DE-4	Daily	CUM	Daily	CUM	Daily	CUM	Daily	CUM	Daily	Daily
1-Mar	1360	13.3	1360	13.3	722	1142	93	0	6300	0	12250	1205	1205	1179	1179	1198	1198	18550	18550	3582	22132
2-Mar	1450	13	2810	26.3	730	1162	92	1050	4200	5600	10500	1108	2313	1057	2236	1036	2233	21350	39900	3200	24550
3-Mar	1650	11	4460	37.3	807	1171	90	5250		14000		738	3051	709	2944	724	2957	19250	59150	2170	21420
4-Mar	1670	24.5	6130	61.8	740	1049	87	3150		16800		273	3324	284	3228	258	3215	19950	79100	795	20745
5-Mar	1170	0	7300	61.8	1054	1016	85	1050		11200		3238	6562	2913	6121	1753	4968	12250	91350	7905	20155
6-Mar	1740	19.5	9040	81.3	1828	1214	85	5250		16800		953	7516	925	7046	887	5855	22050	113400	2775	24825
7-Mar	1990	15.5	11030	96.8	721	1301	98	7350		14000		552	8068	542	7588	539	6404	21350	134750	1833	22883
8-Mar	1880	0	12910	96.8	1845	1392	95	7350		16800		1934	10002	1866	9454	1773	8177	24150	158900	5573	29723
9-Mar	1960	30	14870	126.8	712	1508	95	3150		14000		1123	11125	1116	10570	1126	9312	17150	176050	3374	20524
10-Mar	1680	0	16550	126.8	549	1244	94	4200		16800		558	11683	642	11212	695	10007	21000	197050	1898	22898
11-Mar	1340	15	17890	141.8	937	968	82			14000		1590	13273	1466	12679	1476	11483	14000	211050	4532	18532
12-Mar	1280	15	19170	156.8	2135	975	77	1050		16800		2081	15354	1886	14565	1801	13284	17850	228900	5768	23618
13-Mar	1820	25	20990	181.8	1827	1119	88	5250		14000		178	15530	181	14746	188	13473	19250	248150	546	19796
14-Mar	1810	15	22800	196.8	717	1158	94		5250	16800		321	15851	279	15025	285	13738	22050	270200	865	22915
15-Mar	1950	0	24750	196.8	1900	1105	93	7350		16800		278	16129	280	15305	306	14044	24150	294350	864	25014
16-Mar	1870	15	26620	211.8	1900	1135	94	6300		16800		257	16386	251	15556	252	14296	23100	317450	1060	24160
17-Mar	1690	40	28310	251.8	700	1040	93	4200		14000		601	17087	625	16281	678	15074	18200	335650	1904	20104
18-Mar	1480	30	29790	281.8	800	940	95	2100	5250	5600	10500	288	17375	251	16532	229	15303	23450	359100	768	24218
19-Mar	1040	25	30830	306.8	800	831	85		4200		10500	1882	19307	1904	18436	1835	17138	14700	373800	5731	20431
20-Mar	1190	0	32020	306.8	2000	1100	81		4200		12250	1698	21285	1973	20409	2067	19225	16450	390250	5958	22408
21-Mar	1540	0	33560	306.8	2100	1090	82		7350		12250	717	21982	649	21058	613	19838	19600	409850	1979	21579
22-Mar	1410	30	34970	336.8	559	1180	91		6300		12250	1637	23619	1511	22569	1444	21282	18550	428400	4592	23142
23-Mar	1530	0	36500	336.8	600	1150	95		7350		14000	867	24486	800	23369	785	22067	21350	449750	2452	23802
24-Mar	1210	0	37710	336.8	818	1125	93		4200		14000	1759	26245	1684	25053	1657	23724	18200	467950	5100	23300
25-Mar	1490	15	39200	351.8	2047	1108	98	5250			14000	1157	27402	1087	26140	1114	24838	19250	487200	3358	22608
26-Mar	1520	0	40720	351.8	542	1132	98	7350			14000	1162	28564	1071	27211	1060	25898	21350	508550	3293	24643
27-Mar	1240	15	41960	366.8	810	1304	89	4200			12250	2490	31054	2343	29554	2337	28235	16450	525000	7170	23620
28-Mar	1410	25	43370	401.8	538	1148	88	6300			12250	1640	32694	1555	31109	1542	29777	19550	543550	4737	23287
29-Mar	1540	0	44910	401.8	737	1250	90	8400			14000	912	33606	894	32003	911	30688	22400	565950	2717	25117
30-Mar	1760	20	46670	421.8	641	1197	94		6300	14000		141	33747	128	32131	135	30823	20300	586250	404	20704
31-Mar	2130	220	48800	641.8	545	997	93		3150	5600	8750	1248	34997	1198	33329	1248	32071	17500	603750	3686	21186
MONTH TOTAL			48800	641.8									34997		33329		32071		603750		704137
KWH PRODUCED PER GAL OF #2 DIESEL FUEL																					12.37
DIESEL GENERATION PRODUCTION EFFICIENCY																					38.82%
% WIND TURBINE KWH PRODUCED TO TOTAL GRID																					14.26%
FUEL SAVINGS BY WIND TURBINE OPERATIONS IN GALLONS (AVOIDED GALLONS USED)																					0114
AIR EMISSIONS AVOIDED BY WIND TURBINES IN POUNDS												CO2 =	182314		CO =	1056		NOx =	4902	SO2 =	322
												PM<10 =	345		TOC =	400		Aldehydes =	78		

March 2 – Problems with “D” line – WT’s off line. Lost WT production = 50 kWh
March 5 – Problems with “A” line – WT’s off line. Lost WT production = 2,300 kWh

San Clemente Island, CA
April 2000
Electrical Production, Fuel Use, and Emission Factors

	Fuel & Lube Oil Used							Diesel Generators				225kW Wind Turbines						Total Diesel		Tot. WT	Grid Load
	Daily		Total		Daily Pk Demand		Avg	500 KW	500 KW	1.2 MW	750 KW	225kW_WT-1		225kW_WT-2		225kW_WT-3		KWH		KWH	Tot. KWH
Date	Fuel	Lube	Fuel	Lube	Time	Load	PF	DE-1	DE-2	DE-3	DE-4	Daily	CUM	Daily	CUM	Daily	CUM	Daily	CUM	Daily	Daily
1-Apr	810		810	0.0	1800	898	78	2100	2100		7000	2848	2848	2905	2905	2845	2845	11200	11200	8598	19798
2-Apr	1050		1860	0.0	600	969	94		4200		10500	1317	4165	1242	4147	1188	4033	14700	25900	3747	18447
3-Apr	1680		3540	0.0	2200	1014	98	5250		14000		511	4676	539	4685	559	4592	19250	45150	1609	20859
4-Apr	1630		5170	0.0	1200	1147	93	3150		16800		2237	6913	2074	6759	2007	6599	19950	65100	6319	26269
5-Apr	1370		6540	0.0	2248	1021	84	1050		14000		3583	10496	3382	10141	3298	9897	15050	80150	10263	25313
6-Apr	1700	25	8240	25.0	722	1194	78	4200		16800		1445	11941	1361	11502	1361	11258	21000	101150	4167	25167
7-Apr	1630		9870	25.0	405	1228	77	4200		16800		1013	12954	933	12435	933	12191	21000	122150	2879	23879
8-Apr	1290	15	11160	40.0	634	1023	83	1050		14000		2193	15147	2042	14477	2057	14248	15050	137200	6292	21342
9-Apr	1050	10	12210	50.0	416	769	98			11200		4014	19161	2535	17012	3657	17905	11200	148400	10206	21406
10-Apr	1570	15.2	13780	65.2	605	1040	81	3150		16800		1171	20332	1084	18076	1064	18969	19950	168250	3299	23249
11-Apr	1890	10	15670	75.2	1750	1239	95	6300		16800		159	20491	155	18231	161	19130	23100	191450	475	23575
12-Apr	1730	23	17400	98.2	1100	1136	94	4200		16800		589	21080	512	18743	488	19618	21000	212450	1589	22589
13-Apr	1270	22	18670	120.2	700	998	94	1050		11200		2318	23398	2142	20885	2078	21696	12250	224700	6538	18788
14-Apr	1150	13.2	19820	133.4	600	808	94	2100	1050	11200		2328	25726	2213	23098	2216	23912	14350	239050	6757	21107
15-Apr	1440	17.6	21260	151.0	2300	783	94	7350	7350			1265	26991	1207	24305	1184	25096	14700	253750	3656	18356
16-Apr	1330		22590	151.0	800	911	93	8400	8400			401	27392	407	24712	407	25503	16800	270550	1215	18015
17-Apr	2020	26.4	24610	177.4	1300	842	93	5250	2100	8400		3224	30616	1840	26552	3124	28627	15750	286300	7988	23738
18-Apr	1450		26060	177.4	1800	1072	94	3150		14000		2698	33314	2348	28900	2511	31138	17150	303450	7557	24707
19-Apr	1500	10	27560	187.4	741	1191	85		9450		14000	728	34040	697	29597	692	31830	23450	326900	3115	25565
20-Apr	1320		28880	187.4	921	884	92		6300		12250	1359	35399	1222	30819	1194	33024	18550	345450	3775	22325
21-Apr	860	15	29920	202.4	353	917	92		2100		10500	2494	37893	2433	33022	2378	35402	12600	358050	7275	19875
22-Apr	740		30660	202.4	1300	830	84		1050		10500	3155	41048	3014	36036	2963	38365	11550	369600	8032	20582
23-Apr	1100	60	31760	262.4	2346	885	78		2100		14000	1239	42287	1163	37199	1169	39434	16100	385700	3571	19671
24-Apr	1720	25	33480	287.4	1754	1049	88	8400	7350	2800		291	42578	258	37457	260	39694	18550	404250	809	19359
25-Apr	1760	15.2	35240	302.6	1862	1104	93	4200		16800		460	43038	417	37874	389	40083	21000	425250	1276	22276
26-Apr	1830	0	37070	302.6	1240	1144	93	5250		16800		1	43039	0	37874	2	40085	22050	447300	3	22053
27-Apr	1590	37.4	38660	340.0	855	1081	92	3150		14000		840	43879	794	38668	789	40884	17150	464450	2423	19573
28-Apr	750	0	39410	340.0	700	1020	79			2800	7000	3457	47332	3354	42022	3224	44108	9800	474250	10031	19831
29-Apr	1130	0	40540	340.0	718	915	73		4200		10500	901	48233	860	42882	974	45082	14700	488950	2835	17535
30-Apr	1380	15.4	41920	355.4	725	910	79		3150	11200	7000	547	48780	480	43462	455	45537	21350	510300	1482	22832
1-May			41920	355.4									48780		43462		45537	0	510300	0	0
MONTH TOTAL			41920	355.4									48780		43462		45537		510300		648879
KWH PRODUCED PER GAL OF #2 DIESEL FUEL																					12.17
DIESEL GENERATION PRODUCTION EFFICIENCY																					38.33%
% WIND TURBINE KWH PRODUCED TO TOTAL GRID																					21.26%
FUEL SAVINGS BY WIND TURBINE OPERATIONS IN GALLONS (AVOIDED GALLONS USED)																					11318
AIR EMISSIONS AVOIDED BY WIND TURBINES IN POUNDS												CO2 =	254308	CO =	1473	NOx =	6838		SO2 =	450	
												PM<10 =	481	TOC =	558	Aldehydes =	109				

WT shutdown low diesel production
4/1/00 – T#1 ~ 5 hrs, 4/17/00 – #1 ~ 4 hrs
enXco PM maintenance shutdown – T#2 ~2.1 hrs
4/18/00 – T#2 ~ 2 hrs – T#3 ~ 1.5 hrs
enXco scheduled maintenance shutdown 4/17/00 – T#2 ~ 2.2 hr
4/18/00 – T#2, T#3 ~ 2 hrs each

San Clemente Island, CA
May 2000
Electrical Production, Fuel Use, and Emission Factors

	Fuel & Lube Oil Used							Diesel Generators				225kW Wind Turbines						Total Diesel		Tot. WT	Grid Load
	Daily		Total		Daily Pk Demand		Avg	500 KW	500 KW	1.2 MW	750 KW	225kW_WT-1		225kW_WT-2		225 KW_WT-3		KWH		KWH	Tot KWH
Date	Fuel	Lube	Fuel	Lube	Time	Load	PF	DE-1	DE-2	DE-3	DE-4	Daily	CUM	Daily	CUM	Daily	CUM	Daily	CUM	Daily	Daily
1-May	1540	0	1540	0.0	1100	945	90	3150		14000		793	793	710	710	888	888	17150	17150	2191	19341
2-May	1490	19.8	3030	19.8	600	1015	88	3150		16800		1399	2192	1313	2023	1289	1976	19950	37100	4000	23950
3-May	1710		4740	19.8	1105	1059	94	5250		14000		531	2723	487	2490	460	2436	19250	56350	1458	20708
4-May	1580	25	6320	44.8	746	1184	96	2100		19600		39	2762	40	2530	40	2476	21700	78050	119	21819
5-May	1620		7940	44.8	855	958	93	1050		16800		794	3556	734	3264	732	3208	17850	95900	2260	20110
6-May	1480	25	9420	69.8	725	955	91	4200		14000		1364	4920	1270	4534	1279	4487	19200	114100	3913	23113
7-May	980		10380	69.8	855	851	83			11200		3308	8229	3285	7739	3094	7581	11200	125300	9608	20808
8-May	990		11370	69.8	1113	862	83			8400		3376	11605	3244	10983	3177	10758	8400	133700	6797	18197
9-May	1360	15	12730	84.8	749	1028	94	4200		16800		2154	13759	2038	13021	1973	12731	21000	154700	6165	27165
10-May	860		13590	84.8	700	1200	88			8400		4259	18017	4237	17258	4042	16773	8400	163100	12537	20937
11-May	1180	15	14870	99.8	920	1068	89			14000		2600	20617	2832	20090	2863	19636	14000	177100	8295	22295
12-May	1550	20	16420	119.8	842	1044	81	3150		14000		466	21083	399	20489	384	20020	17150	194250	1249	18399
13-May	1250	0	17670	119.8	800	870	87			16800		1088	22171	1088	21577	1088	21108	16800	211050	3264	20064
14-May	1150	20	18820	139.8	2100	810	88			11200		1927	24098	1676	23253	1616	22724	11200	222250	5219	16419
15-May	1420		20240	139.8	2000	970	88			16800		1078	25176	996	24249	976	23700	16800	239050	3050	19850
16-May	1130	25	21370	164.8	2000	1000	88	1050		11200		3035	28211	2910	27157	2878	26578	12250	251300	8831	21081
17-May	1450		22820	164.8	758	1082	86	2100		14000		1685	29896	1686	28843	1689	28277	16100	267400	5080	21180
18-May	1520	14	24340	179.8	854	1008	79			16800		528	30424	494	29357	507	28784	16800	287000	1529	21129
19-May	1400	20	25820	188.8	838	980	79			16800		323	30747	287	29644	310	29094	16800	303800	930	17730
20-May	1580		27400	198.8	2050	1079	78	1050		19600		530	31277	409	30153	493	29587	20650	324450	1522	22172
21-May	1680	30	29080	228.8	23	982	81	2100		16800		64	31341	87	30220	77	29664	18900	343350	208	19108
22-May	1630		30720	228.8	721	972	87			19600		44	31385	40	30260	53	29717	19600	362950	137	19737
23-May	1630	15	32350	243.8	2001	958	81			19600		122	31507	132	30392	126	29843	19600	382550	380	19980
24-May	1510	15	33860	258.8	1200	930	93	3150	1050	11200	3500	135	31642	145	30537	126	29969	18900	401450	406	19306
25-May	1160		35020	258.8	712	942	95		4200		12250	869	32511	813	31350	822	30791	16450	417900	2504	18954
26-May	1330	5	36350	263.8	815	928	95		1050	11200	5250	558	33069	524	31874	530	31321	17500	435400	1612	19112
27-May	1170	25	37520	288.8	2245	890	96		4200		12250	116	33185	117	31991	130	31451	16450	451850	363	16813
28-May	1440	0	38960	288.8	1700	867	95	7350	9450			89	33274	98	32089	89	31540	16800	468650	266	17066
29-May	1520	45	40480	333.8	2100	916	94	9450	8400			24	33298	21	32110	28	31568	17850	486500	71	17921
30-May	1470	0	41950	333.8	2300	1121	93	6300	8400		5250	1177	34475	1104	33204	1087	32653	19950	506450	3378	23328
31-May	1620	0	43570	333.8	800	1053	98	9450			12250	320	34795	302	33506	304	32957	21700	528150	926	22626
MONTH TOTAL			43570	333.8									34795		33506		32957		528150		629410
KWH PRODUCED PER GAL OF #2 DIESEL FUEL																					12.12
DIESEL GENERATION PRODUCTION EFFICIENCY																					30.20%
% WIND TURBINE KWH PRODUCED TO TOTAL GRID																					16.09%
FUEL SAVINGS BY WIND TURBINE OPERATIONS IN GALLONS (AVOIDED GALLONS USED)																					8354
AIR EMISSIONS AVOIDED BY WIND TURBINES IN POUNDS												CO2 =	187708	CO =	1087	NOx =	5048	SO2 =	332		
												PM<10 =	355	TOC =	412	Aldehydes =	88				

San Clemente Island, CA
June 2000
Electrical Production, Fuel Use, and Emission Factors

	Fuel & Lube Oil Used							Diesel Generators				225kW Wind Turbines						Total Diesel		Tot. WT	Grid Load
	Daily		Total		Daily Pk Demand		Avg	500 KW	500 KW	1.2 MW	750 KW	225kW_WT-1		225kW_WT-2		225 KW_WT-3		KWH		KWH	Tot KWH
Date	Fuel	Lube	Fuel	Lube	Time	Load	PF	DE-1	DE-2	DE-3	DE-4	Daily	CUM	Daily	CUM	Daily	CUM	Daily	CUM	Daily	Daily
1-Jun	1460	0	1460	0.0	840	1040	93		7350		12250	252	252	237	237	231	231	19600	19600	720	20320
2-Jun	1280	16.7	2740	16.7	512	1009	93		6300		12250	658	910	599	836	576	806	18550	38150	1832	20382
3-Jun	1130	0	3870	16.7	744	905	91		1050		15750	905	1815	813	1649	803	1609	16800	54950	2521	19321
4-Jun	840	20	4710	36.7	2100	934	91		1050		14000	2648	4461	2473	4122	2411	4020	15050	70000	7530	22580
5-Jun	830	0	5540	36.7	1038	1074	85		1050		10500	2918	7377	2759	6881	2702	6722	11550	81550	8377	19927
6-Jun	1230	0	6770	36.7	1835	1135	86		4200		14000	1512	8889	1426	8307	1432	8154	18200	99750	4370	22570
7-Jun	970	27	7740	63.7	700	887	84		2100		14000	2628	11517	2473	10784	2420	10574	16100	115850	7525	23625
8-Jun	1550	17	9290	80.7	1300	727	84		1050	5600	7000	3218	14735	3161	13945	3119	13693	13650	129500	9498	23148
9-Jun	1340		10630	80.7	600	924	81	1050		11200		1966	16701	1880	15825	1833	15526	12250	141750	5659	17909
10-Jun	1490	30	12120	110.7	1100	885	90			19600		602	17303	616	16421	629	16155	19600	161350	1927	21527
11-Jun	1580		13700	110.7	2100	942	90			16800		221	17604	207	16628	201	16356	16800	178150	629	17429
12-Jun	1840		15540	110.7	2100	812	90	5250		16800		43	17647	37	16665	41	16397	22050	200200	121	22171
13-Jun	1990		17530	110.7	1700	1114	94	7350		14000		173	17820	176	16841	178	16575	21350	221550	527	21877
14-Jun	1890	19	19520	129.7	1320	1204	94	8400		14000		185	18005	197	17038	202	16777	22400	243950	584	22984
15-Jun	1780	15	21300	144.7	747	1073	93	4200		16800		918	18915	864	17902	866	17643	21000	264950	2640	23640
16-Jun	1570	35	22870	179.7	810	1098	94	3150		2800	10500	247	19162	228	18130	235	17878	16450	281400	710	17160
17-Jun	1340		24210	179.7	1054	890	89	5250			12250	180	19342	175	18305	170	18048	17500	298900	525	18025
18-Jun	1370	15	25580	194.7	1056	898	94	7350			10500	74	19416	82	18387	73	18121	17850	316750	229	18079
19-Jun	1400	20	26980	214.7	1300	944	93	5250			14000	302	19718	286	18673	281	18412	19250	336000	879	20129
20-Jun	1430		28410	214.7	842	1028	92	6300			12250	496	20214	426	19089	422	18834	18550	354550	1344	19894
21-Jun	1360	20	29760	234.7	600	1100	92	6300			12250	815	21129	844	19943	837	19671	18550	373100	2586	21146
22-Jun	1840		31600	234.7	1100	950	93	5250		8400	7000	737	21866	696	20639	703	20374	20650	393750	2136	22786
23-Jun	2030		33630	234.7	1200	1104	96	6300		11200		57	21923	53	20692	53	20427	17500	411250	163	17663
24-Jun	1710	40	35340	274.7	600	930	94	2100		16800		484	22387	420	21112	412	20839	18900	430150	1296	20196
25-Jun	1510		36850	274.7	1100	1019	94	1050		14000		928	23315	876	21948	837	21676	15050	445200	2692	17652
26-Jun	1400	20	38250	294.7	1400	1036	92			16800		2068	25382	1862	23810	1871	23547	16800	462000	5799	22599
27-Jun	1590		39840	294.7	1100	1012	92	2100		14000		1806	27188	1659	25469	1620	25167	16100	478100	5085	21185
28-Jun	1790	15	41630	309.7	813	1169	99	3150		16800		597	27785	551	26020	522	25689	19950	498050	1680	21630
29-Jun	1480	25	43110	334.7	855	1021	91	2100		16800		1578	29363	1509	27529	1466	27155	18900	516950	4553	23453
30-Jun	1320		44430	334.7	511	873	87			11200	1750	1411	30774	1345	28874	1331	28486	12950	529900	4087	17037
1-Jul	980	10	45410	344.7	1016	811	93				15750	740	31514	690	29564	676	29172	15750	545650	2106	17856
MONTH TOTAL			45410	344.7									31514		29564		29172		545650		635900
KWH PRODUCED PER GAL OF #2 DIESEL FUEL																					12.02
DIESEL GENERATION PRODUCTION EFFICIENCY																					29.93%
% WIND TURBINE KWH PRODUCED TO TOTAL GRID																					14.19%
FUEL SAVINGS BY WIND TURBINE OPERATIONS IN GALLONS (AVOIDED GALLONS USED)																					7511
AIR EMISSIONS AVOIDED BY WIND TURBINES IN POUNDS												CO2 =	168758		CO =	978		NOx =	4538	SO2 =	298
												PM<10 =	319		TOC =	370		Aldehydes =	72		

June 9 – WT 1,2,3 off line 5 min – power plant problem
June 14 – WT 1,2,3 off line 5 min – power plant problem
June 18 – WT 1,2,3 off line 3 1/2 hr – power line down
June 30 – WT 1,2,3 off line X-hr – power plant problem

San Clemente Island, CA
July 2000
Electrical Production, Fuel Use, and Emission Factors

	Fuel & Lube Oil Used							Diesel Generators				225kW Wind Turbines						Total Diesel		Tot. WT	Grid Load
	Daily		Total		Daily Pk Demand		Avg	500 KW	500 KW	1.2 MW	750 KW	225kW_WT-1		225kW_WT-2		225 KW_WT-3		KWH		KWH	Tot KWH
Date	Fuel	Lube	Fuel	Lube	Time	Load	PF	DE-1	DE-2	DE-3	DE-4	Daily	CUM	Daily	CUM	Daily	CUM	Daily	CUM	Daily	Daily
1-Jul	880	10	880	10.0	1800	811	93				15750	740	740	880	880	878	878	15750	15750	2106	17856
2-Jul	840		1820	10.0	700	801	91				12250	1500	2240	1414	2194	1386	2262	12250	28000	4300	16550
3-Jul	440	15	2260	25.0	800	806	82				7000	3405	5645	2269	5372	2203	5265	7000	35000	8876	15876
4-Jul	450		2710	25.0	1100	741					7000	3376	9021	3255	8627	3198	8463	7000	42000	8829	15829
5-Jul	830		3540	25.0	1900	855	85				14000	1869	10890	1757	10384	1736	10199	14000	56000	5362	19362
6-Jul	730	15	4270	40.0	1200	910	88		1050		10500	2721	13611	2571	12955	2523	12722	11550	67550	7815	19365
7-Jul	850	45	5120	85.0	2100	825	82			2800	5250	2568	16161	2481	15356	2349	15071	8050	75600	7300	15350
8-Jul	1090		6210	85.0	2200	785	80				15750	487	16648	438	15794	447	15518	15750	91350	1372	17122
9-Jul	1060		7270	85.0	1100	915	87		2100		14000	1524	18172	1480	17254	1456	16974	16100	107450	4440	20540
10-Jul	1240		8510	85.0	2100	1145	87		5250		12250	649	18821	590	17844	585	17559	17500	124950	1824	19324
11-Jul	1300		9810	85.0	2100	865	89		6300		12250	338	19159	313	18157	311	17870	18550	143500	962	19512
12-Jul	1180	25	10990	110.0	905	988	89		5250		12250	1049	20208	958	19125	948	18818	17500	161000	2965	20465
13-Jul	800		11870	110.0	905	880	88		1050		10500	2405	22613	2276	21401	2240	21058	11550	172550	8921	18471
14-Jul	710		12580	110.0	1113	724	78				10500	2888	25499	2724	24125	2640	23698	10500	183050	8250	18750
15-Jul	780	22	13360	132.0	900	727	78				12250	2451	27950	2286	26411	2204	25902	12250	195300	6941	19191
16-Jul	770		14130	132.0	37	717	81			2800	7000	3424	31374	2798	29209	2728	28641	9800	205100	8981	18781
17-Jul	1170		15300	132.0	1202	794	77			11200		2935	34309	2759	31968	2838	31279	11200	216300	8332	19532
18-Jul	1170	15	16470	147.0	830	798	79			14000		3166	37475	3016	34984	2987	34166	14000	230300	8069	23069
19-Jul	1840	0	18110	147.0	1200	1145	88	4200		11200		1540	39015	1439	36423	1404	35570	15400	245700	4373	19773
20-Jul	1300	0	19410	147.0	1400	1075	93		7350		12250	1051	40066	935	37348	954	36524	19600	265300	2940	22540
21-Jul	1470	35	20880	182.0	800	1026	89		9450		10500	187	40253	146	37494	169	36693	19950	285250	502	20452
22-Jul	1800	0	22680	182.0	1700	958	95	5250		8400	8750	97	40350	77	37571	92	36785	22400	307650	266	22666
23-Jul	1710		24390	182.0	1200	877	94	2100		14000	1750	109	40459	104	37675	110	36895	17850	325500	323	18173
24-Jul	1360	20	25850	202.0	1800	1000	88	6300			12250	1226	41685	1142	38817	1160	38055	18550	344050	3528	22078
25-Jul	1210	15	27060	217.0	800	1031	84	5250			10500	2063	43745	1903	40720	1864	39919	15750	359800	5827	21577
26-Jul	1650		28710	217.0	700	1170	92	9450			14000	246	43991	232	40942	224	40143	23450	383250	692	24142
27-Jul	1530		30240	217.0	1203	1140	94	7350			12250	451	44442	395	41337	386	40529	19600	402850	1232	20832
28-Jul	1350	35	31590	252.0	635	947	97	7350			12250	995	45437	905	42242	889	41428	19600	422450	2799	22399
29-Jul	1190		32780	252.0	1534	935	91	5250			10500	1218	46655	1106	43348	1084	42512	15750	438200	3408	19158
30-Jul	1220	35	34000	287.0	2155	971		4200			12250	570	47225	535	43883	527	43039	16450	454650	1632	18082
31-Jul	1590	10	35590	297.0	2119	1235		8400			14000	181	47406	176	44059	190	43229	22400	477050	547	22947
MONTH TOTAL			35590	297.0									47406		44059		43229		477050		611784
KWH PRODUCED PER GAL OF #2 DIESEL FUEL																					13.40
DIESEL GENERATION PRODUCTION EFFICIENCY																					33.39%
% WIND TURBINE KWH PRODUCED TO TOTAL GRID																					22.02%
FUEL SAVINGS BY WIND TURBINE OPERATIONS IN GALLONS (AVOIDED GALLONS USED)																					10349
AIR EMISSIONS AVOIDED BY WIND TURBINES IN POUNDS												CO2 =	225784		CO =	1308		NOx =	6871	SO2 =	399
												PM<10 =	427		TOC =	496		Aldehydes =	96		

July 1 – WT 1,2,3 off line ?-hr – power plant problems
July 19–20 – WT 1,2,3 off line 2-hrs – power plant problems
July 23 – WT 3 off line 2-hrs – wind sensor changeout
July 25 – WT 1,2,3 off line – grid problem – 5-min
Wind Turbine #3 placed in operation July 3, 1999 at 10 a.m.
July 27 – discovered that CR Ratio was set to 500:1 instead of 800:1
Spreadsheet has been corrected for ~40% additional energy production for Turbine #3 for July 3 – 27 due to a wrong CT Ratio

San Clemente Island, CA
August 2000
Electrical Production, Fuel Use, and Emission Factors

	Fuel & Lube Oil Used							Diesel Generators				225kW Wind Turbines						Total Diesel		Tot. WT	Grid Load
	Daily		Total		Daily Pk Demand		Avg	500 KW	500 KW	1.2 MW	750 KW	225kW_WT-1		225kW_WT-2		225 KW_WT-3		KWH		KWH	Tot KWH
Date	Fuel	Lube	Fuel	Lube	Time	Load	PF	DE-1	DE-2	DE-3	DE-4	Daily	CUM	Daily	CUM	Daily	CUM	Daily	CUM	Daily	Daily
1-Aug	1740		1740	0.0	552	1227	94	8400			14000		0		0		0	22400	22400	0	22400
2-Aug	1640		3380	0.0	1200	1109	94	5250	5250		14000	1896	1896	1788	1788	1786	1786	24500	46900	5470	29970
3-Aug	1410		4790	0.0	700	979	94		7350		12250	1092	2979	1097	2785	999	2785	19600	66500	3088	22688
4-Aug	1200		5990	0.0	400	976	94		5250		12250	1618	4594	1510	4305	1469	4274	17500	84000	4615	22115
5-Aug	1120	24.2	7110	24.2	700	876	92	1050	2100		12250	1935	6429	1707	6012	1710	5984	15400	99400	5252	20652
6-Aug	1490		8600	24.2	800	956	94	6300			14000	564	6993	532	6544	547	6531	20300	119700	1643	21943
7-Aug	2000		10600	24.2	800	933	94	7350			14000	348	7339	321	6865	319	6850	21350	141050	988	22338
8-Aug	1400	35.2	12000	59.4	1100	990	94	6300			12250	937	8276	838	7703	836	7686	18550	159600	2611	21161
9-Aug	1310	2.2	13310	61.6	1049	1120	91	6300			12250	1908	10184	1751	9454	1735	9421	18550	178150	5394	23944
10-Aug	880		14190	61.6	546	880	88	2100			10500	2751	12935	2559	12013	2511	11932	12600	190750	7821	20421
11-Aug	1070		15260	61.6	659	832	83	3150			12250	1360	14295	1247	13260	1242	13174	15400	206150	3849	19249
12-Aug	1320	15	16580	76.6	1029	934	88	3150	4200		10500	166	14461	144	13404	148	13322	17850	224000	458	18308
13-Aug	1310		17890	76.6	1727	938	94		7350		10500	43	14504	40	13444	48	13370	17850	241850	131	17981
14-Aug	1420		19310	76.6	2114	1007	93		8400		12250	25	14529	30	13474	23	13393	20650	262500	78	20728
15-Aug	1660	40.3	20970	116.9	2011	1209	93		9450		14000	90	14619	95	13569	9	13402	23450	285950	194	23644
16-Aug	1800	0.4	22860	117.3	930	1185	94		9450		14000		14619		13569		13402	23450	309400	0	23450
17-Aug	1570		24230	117.3	1015	1135	96		8400		14000	283	14902	287	13836	288	13670	22400	331800	818	23218
18-Aug	1500	233	25730	350.5	915	1088	94		8400		12250	178	15072	188	14024	178	13848	20650	352450	516	21166
19-Aug	1850		27580	350.5	1102	1087	94	1050	4200	11200	10500	600	15672	556	14580	555	14403	28950	379400	1711	28661
20-Aug	1350	26.4	28730	376.9	3	905	94			14000		1879	17551	1758	16338	1881	16084	14000	393400	5318	19318
21-Aug	1650		30380	376.9	1201	965	91	2100		16800		624	18175	581	16879	548	16632	18900	412300	1733	20633
22-Aug	1710	33	32090	409.9	2005	995	91	3150		14000		628	18803	581	17460	556	17188	17150	429450	1795	18915
23-Aug	1490		33580	409.9	800	1018	91	240	100	830	320	1348	20151	1247	18707	1182	18380	1490	430940	3787	5277
24-Aug	1330		34910	409.9	2000	1113	92		6300		12250	803	20954	724	19431	704	19084	18550	449490	2231	20781
25-Aug	1100	15	36000	424.9	800	921	93		6300		10500	1311	22265	1185	20616	1130	20222	16800	466290	3634	20434
26-Aug	1110	15	37200	439.9	2100	903	91		4200		12250	1098	23363	1015	21631	980	21202	16450	482740	3093	19543
27-Aug	1130		38330	439.9	800	875	92		5250		12250	851	24214	794	22425	766	21968	17500	500240	2401	19901
28-Aug	1290		39620	439.9	1800	914	93		6300		10500	434	24648	406	22831	389	22346	16800	517040	1228	18028
29-Aug	1390	30	41010	469.9	2000	975	94		8400		12250	808	25456	760	23591	721	23067	20650	537690	2289	22939
30-Aug	1390		42400	469.9	700	970	93		7350		14000	717	26173	688	24279	679	23746	21350	559040	2084	23434
31-Aug			42400	469.9	1000	1037	94		4200		10500	1238	27409	1158	25437	1149	24895	14700	573740	3543	18243
MONTH TOTAL			42400	469.9									27409		25437		24895		573740		651481
KWH PRODUCED PER GAL OF #2 DIESEL FUEL																					13.53
DIESEL GENERATION PRODUCTION EFFICIENCY																					33.71%
% WIND TURBINE KWH PRODUCED TO TOTAL GRID																					11.93%
FUEL SAVINGS BY WIND TURBINE OPERATIONS IN GALLONS (AVOIDED GALLONS USED)																					5745
AIR EMISSIONS AVOIDED BY WIND TURBINES IN POUNDS												CO2 =	129087		CO =	748		NOx =	3471	SO2 =	228
												PM<10 =	244		TOC =	203		Aldehydes =	55		

August 8 – WT 1,2,3 off line – 5 min due to power plant problem

San Clemente Island, CA
September 2000
Electrical Production, Fuel Use, and Emission Factors

	Fuel & Lube Oil Used							Diesel Generators				225kW Wind Turbines						Total Diesel		Tot. WT	Grid Load
	Daily		Total		Daily Pk Demand		Avg	500 KW	500 KW	1.2 MW	750 KW	225kW_WT-1		225kW_WT-2		225 kW_WT-3		KWH		KWH	Tot. KWH
Date	Fuel	Lube	Fuel	Lube	Time	Load	PF	DE-1	DE-2	DE-3	DE-4	Daily	CUM	Daily	CUM	Daily	CUM	Daily	CUM	Daily	Daily
1-Sep	1060		1060	0.0	2100	753			4200		12250	852	852	798	798	786	786	16450	16450	2436	18886
2-Sep	920	20	1980	20.0	2100	805					14000	1222	2074	1193	1991	1202	1988	14000	30450	3607	17607
3-Sep	730	35	2710	55.0	2200	845					10500	2245	4319	2102	4093	2075	4063	10500	40950	6422	16922
4-Sep	850		3560	55.0	1015	808					14000	1514	5833	1383	5466	1344	5407	14000	54950	4241	18241
5-Sep	1210		4770	55.0	1800	875			5250		12250	837	6470	570	6036	569	5976	17500	72450	1776	19276
6-Sep	1670	50	6440	105.0	1100	1053			7350	8400	5250	196	6666	193	6219	189	6175	21000	93450	578	21578
7-Sep	1410	15	7850	120.0	1100	982				16800		1277	7943	1146	7365	1113	7288	16800	110250	3536	20336
8-Sep	1020		8870	120.0	600	971				8400	3500	2377	10320	2189	9554	2122	9410	11900	122150	6688	18588
9-Sep	1200		10070	120.0	2200	812				8400	10500	389	10709	352	9906	361	9771	18900	141050	1102	20002
10-Sep	1280	25	11350	145.0	1700	803				5600	8750	248	10957	221	10127	233	10004	14350	155400	702	15052
11-Sep	1460		12810	145.0	1800	948			2100	5600	12250	268	11225	284	10421	279	10283	19950	175350	841	20791
12-Sep	1720	20	14530	165.0	2000	872			4200	16800		120	11345	140	10561	153	10436	21000	196350	413	21413
13-Sep	1750	0	16280	165.0	1100	1075		2100	3150	14000		841	11986	652	11213	678	11114	19250	215600	1971	21221
14-Sep	1610	35	17890	200.0	1800	955		3150		16800		1063	13049	974	12187	918	12032	19950	235550	2955	22905
15-Sep	1210		19100	200.0	800	921				11200	3500	1418	14468	1281	13448	1212	13244	14700	250250	3892	18592
16-Sep	1100		20200	200.0	2000	842			4200		12250	633	15098	543	13991	538	13782	16450	266700	1711	18161
17-Sep	1250	15	21540	215.0	2100	818			6300		12250	198	15296	201	14192	213	13995	18550	285250	612	19162
18-Sep	1290		22830	215.0	2000	819			5250		14000	308	15604	283	14475	279	14274	19250	304500	870	20120
19-Sep	1470	38	24300	253.0	1800	1055			9450		10500	598	16194	548	15024	531	14805	19950	324450	1670	21620
20-Sep	1620	202	25920	455.0	651	1283			9450		14000	110	16304	107	15131	98	14903	23450	347900	315	23765
21-Sep	1350	0.5	27270	455.5	850	1038			7350		12250	148	16453	148	15279	139	15042	19600	367500	436	20036
22-Sep	1260	18	28530	473.5	739	973				11200	5250	693	17143	713	15992	700	15742	16450	383950	2103	18553
23-Sep	1080		29610	473.5	1734	885					15750	399	17542	385	16377	389	16131	15750	399700	1173	16923
24-Sep	1120		30730	473.5	1042	875		1050			17500	485	18027	432	16809	432	16563	18550	418250	1349	19899
25-Sep	1240	14.1	31970	487.6	629	903		1050		8400	7000	1101	19209	1039	17848	1039	17591	16450	434700	2249	18699
26-Sep	1250	23	33220	510.6	1155	909				14000		1908	21117	1773	19621	1898	19289	14000	448700	5379	19379
27-Sep	1730		34950	510.6	1800	1122		3150		16800		506	21623	510	20131	525	19814	19950	468650	1541	21491
28-Sep	1570	26	36520	536.6	800	890		4200		14000		1261	22974	1256	21387	1213	21027	18200	486850	3870	22070
29-Sep	1330	18	37850	554.6	700	910			4200	5600	8750	408	23382	372	21759	362	21389	18550	505400	1142	19692
30-Sep	1450	35	39300	589.6	2100	881		4200	8400		7000	17	23399	17	21776	15	21404	19600	525000	49	19649
1-Oct			39300	589.6									23399		21776		21404	0	525000	0	0
MONTH TOTAL			39300	589.6									23399		21776		21404		525000		595579
KWH PRODUCED PER GAL OF #2 DIESEL FUEL																					13.36
DIESEL GENERATION PRODUCTION EFFICIENCY																					33.28%
% WIND TURBINE KWH PRODUCED TO TOTAL GRID																					11.25%
FUEL SAVINGS BY WIND TURBINE OPERATIONS IN GALLONS (AVOIDED GALLONS USED)																					4984
AIR EMISSIONS AVOIDED BY WIND TURBINES IN POUNDS										CO2 =	111883		CO =	649		NOx =	3011		SO2 =	198	
										PM<10 =	212		TOC =	246		Aldehydes =	48				

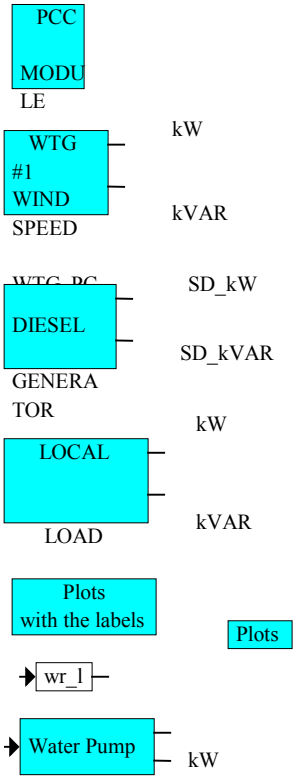
San Clemente Island, CA
October 2000
Electrical Production, Fuel Use, and Emission Factors

	Fuel & Lube Oil Used				Daily Pk Demand		Avg	Diesel Generators				225kW Wind Turbines						Total Diesel		Tot. WT	Grid Load
	Daily		Total					500 KW	500 KW	1.2 MW	750 KW	225kW_WT-1		225kW_WT-2		225 KW_WT-3		KWH		KWH	Tot KWH
Date	Fuel	Lube	Fuel	Lube	Time	Load	PF	DE-1	DE-2	DE-3	DE-4	Daily	CUM	Daily	CUM	Daily	CUM	Daily	CUM	Daily	Daily
1-Oct	1570	5	1570	5.0	600	881	92	9450	9450			138	138	134	134	130	130	18900	18900	402	19302
2-Oct	1470	18	3040	23.0	1200	905	92	9450	9450			1008	1146	915	1049	891	1021	18900	37800	2814	21714
3-Oct	1670		4710	23.0	700	1022	93	9450	10500			67	1213	82	1131	64	1085	19950	57750	192	20142
4-Oct	2170	10	6880	33.0	1800	1028	95	4200	9450		8750	145	1358	138	1269	121	1206	22400	80150	394	22794
5-Oct	1370		8250	33.0	641	1092	94		6300		14000	219	1577	291	1560	291	1497	20300	100450	901	21201
6-Oct	1410	14	9660	47.0	550	1035	93		6300		12250		1577		1560		1497	18550	119000	0	18550
7-Oct	1390		11050	47.0	1916	1139	94		6300		14000	705	2282	634	2194	631	2128	20300	139300	1970	22270
8-Oct	1450	32	12500	79.0	635	1095	94		6300		14000	287	2569	280	2474	269	2397	20300	159600	836	21136
9-Oct	1250		13750	79.0	27	973	98		4200		12250	311	2880	298	2772	301	2698	16450	176050	900	17350
10-Oct	710		14460	79.0	1900	923	75				10500	3298	6178	3184	5956	3087	5785	10500	186550	9569	20069
11-Oct	1190	14.1	15650	93.1	1920	1025	83		5250		12250	1561	7739	1481	7437	1481	7266	17500	204050	4523	22023
12-Oct	1280	17.6	16930	110.7	840	1130	89		4200		12250	1178	8917	1181	8618	1211	8477	16450	220500	3570	20020
13-Oct	1280	31	18210	141.7	700	980	93		4200		15750	639	9556	609	9187	611	9088	19950	240450	1859	21809
14-Oct	1440	18	19650	159.7	830	1120		5250	6300		7000	343	9899	299	9486	285	9373	18550	259000	927	19477
15-Oct	1380		21040	159.7	600	967	92	8400	9450			1163	11162	1092	10578	1057	10430	17850	276850	3302	21152
16-Oct	1590	14	22630	173.7	730	1042	93	9450	9450			445	11607	388	10966	382	10812	18900	295750	1215	20115
17-Oct	1590	16	24220	189.7	630	1242	92	3150	9450		8750	242	11849	216	11172	233	11045	21350	317100	691	22041
18-Oct	1710		25930	189.7	1906	1259	87		9450		12250	205	12054	187	11359	177	11222	21700	338800	569	22269
19-Oct	1560		27490	189.7	854	1214	85		8400		12250	180	12234	184	11543	185	11387	20650	359450	509	21159
20-Oct	1370		28860	189.7	859	1173	88		6300		12250	609	12843	584	12087	555	11942	18550	378000	1728	20278
21-Oct	1470	45	30330	234.7	1815	985	83		6300		16800	618	13461	606	12693	604	12546	23100	401100	1828	24928
22-Oct	1820		31850	234.7	1729	1074	81		2100		16800	107	13568	239	12932	370	12916	18900	420000	716	19616
23-Oct	1340	10	33190	244.7	1834	1015	98		4200	2800	8750	752	14320	787	13719	783	13699	15750	435750	2322	18072
24-Oct	1270		34560	244.7	652	1138	94		7350		12250	272	14592	238	13957	226	13925	19600	455350	736	20336
25-Oct	1650	45	36210	289.7	1800	1200	91		7350		12250	778	15371	726	14683	716	14641	19600	474950	2221	21821
26-Oct	1600	48	37890	337.7	600	1289	92	4200		16800		810	16181	793	15476	788	15429	21000	495950	2401	23401
27-Oct	1740		39630	337.7	600	1004	93	6300		14000		562	16743	558	16034	556	15985	20300	516250	1676	21976
28-Oct	1560		41190	337.7	600	1169	77	3150		16800		778	17463	678	16713	679	16674	19950	536200	2078	22028
29-Oct	1400	20	42590	357.7	1900	872	55	1050		14000		1342	18805	1334	18047	1354	18028	15050	551250	4030	19080
30-Oct	680	10	43270	367.7	1800	1055	86			2800	5250	4381	23186	4276	22322	4022	22050	8050	559300	12678	20728
31-Oct	1230		44500	367.7	1800	969	98		6300		12250	935	24121	1025	23347	1051	23101	18550	577850	2011	21561
MONTH TOTAL			44500	367.7									24121		23347		23101		577850		648419
KWH PRODUCED PER GAL OF #2 DIESEL FUEL																					12.99
DIESEL GENERATION PRODUCTION EFFICIENCY																					32.35%
% WIND TURBINE KWH PRODUCED TO TOTAL GRID																					10.88%
FUEL SAVINGS BY WIND TURBINE OPERATIONS IN GALLONS (AVOIDED GALLONS USED)																					5434
AIR EMISSIONS AVOIDED BY WIND TURBINES IN POUNDS												CO2 =	122107		CO =	707		NOx =	3283	SO2 =	216
												PM<10 =	231		TOC =	268		Aldehydes =	52		

Appendix C. System Transient Simulation

This appendix contains a report on system transient simulation from an NREL senior engineer.

Major components of Power System Modules



INTERACTION BETWEEN WIND TURBINE AND DIESEL GENERATOR WITH LOCAL LOAD

In this study, the power system network consists of Wind Turbine, Diesel Generator, and local load. The local load may consists of a mixture of light load and heavy industrial load.

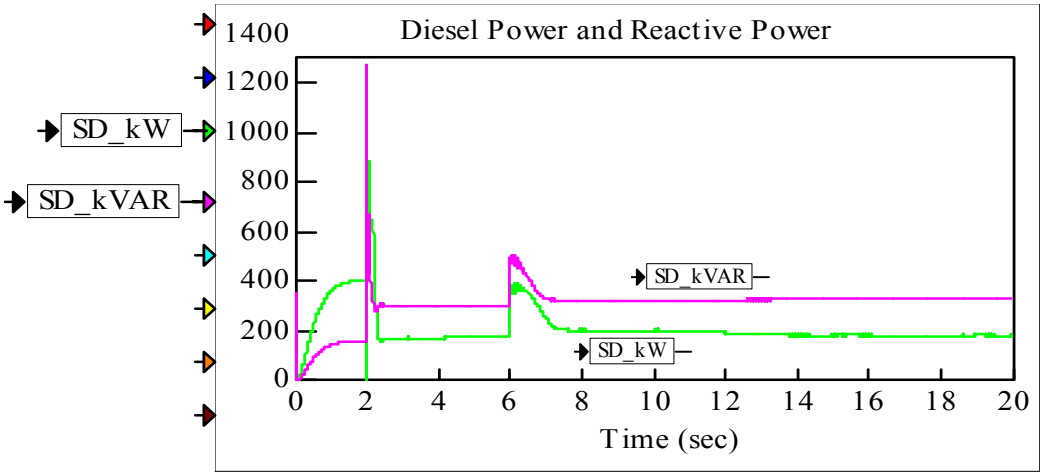
As expected, the heavy loads affect the power quality of the network during transients which may impact the other loads connected to the same power network. In this study, the impact of the loads are investigated:

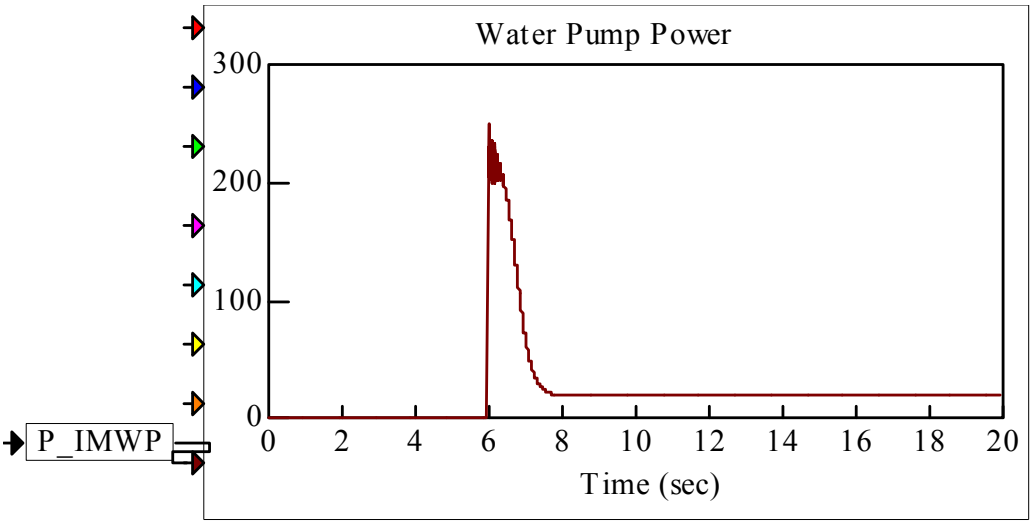
1) wind turbine: during start up, in the low wind speed region, in the high turbulence region

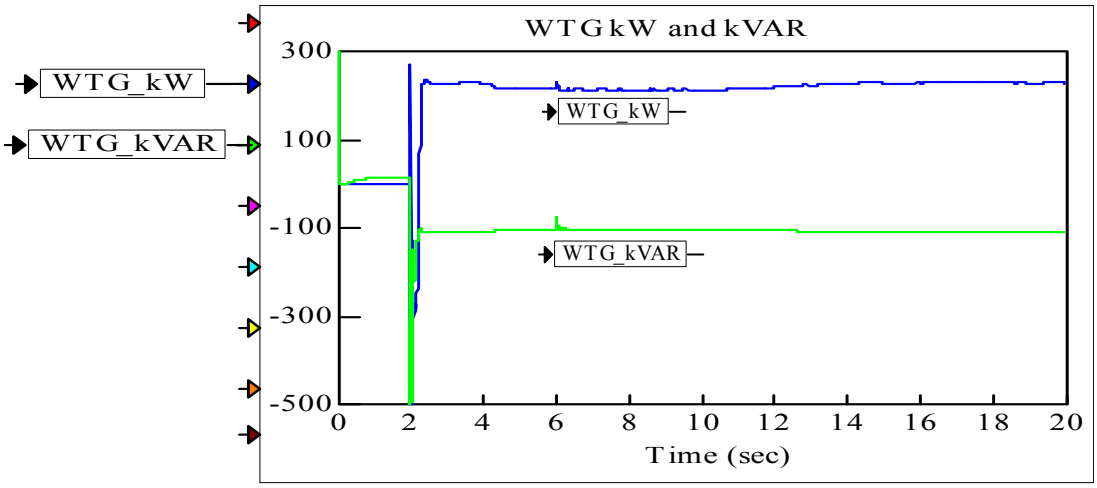
2) heavy loads such as compressors and water pumps during transient condition

The voltage dips and the frequency variations are expected during large transients.

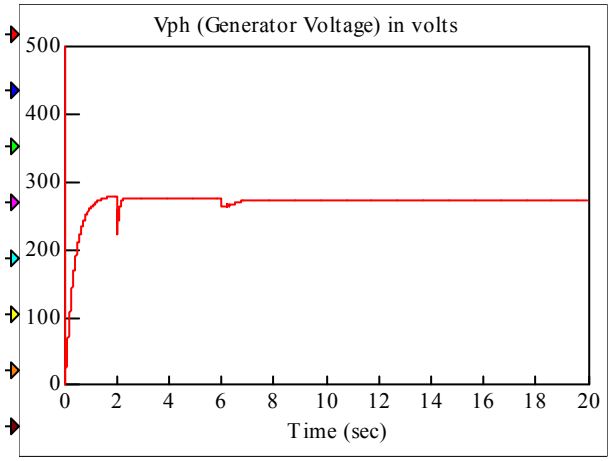
The conservation of real power and reactive power is maintained by the diesel generator. During start up of the wind turbine, the generator must supply the required power and reactive power. However, when the wind turbine starts to generate, the diesel generator starts sharing the load with the wind turbine. The village load (not shown here) is constant at 400 kW.



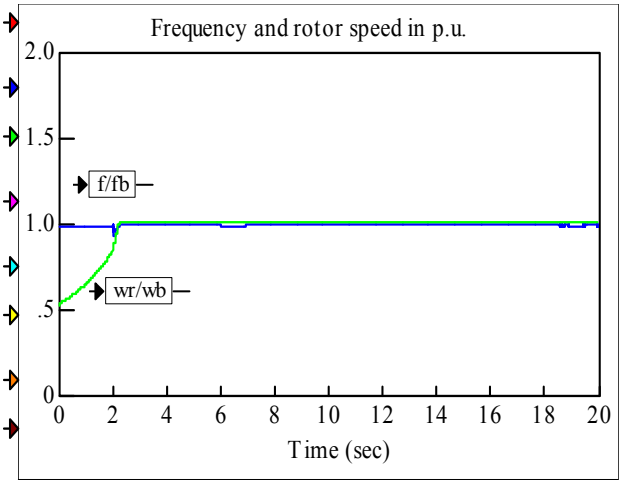




Per Phase Voltage (in volts) and Frequency (in per unit) during steady state and during transient. The first dip in both voltage and frequency is due to the start up of the wind turbine, the second dip in voltage and frequency is due to the start up of the water pump. The wind fluctuation apparently does not present any significant impact on the frequency and the voltage. The voltage is maintained by the field excitation in the diesel generator. The voltage response during transients depends on the ability of the field excitation control to adjust the flux to maintain constant voltage.



The frequency is maintained by the speed governor in the diesel generator. Thus the frequency response during transients depends on the ability of the speed governor to adjust the rotor speed of the diesel engine to maintain constant frequency.



Appendix D. System Electrical Performance Sample Data

This appendix contains some samples of system electrical performance data from the WPMS Data Panel: 24h/10min Datalogs.

WPMS Data Panel: 24h/10min Datalog

18-Feb-20

Current Park: SCI Wind Turbines
Current Turbine: Turbine 1 (1)

	Windspeed	Winddir.	Grid Freq.	Grid L1 V.	Grid L2 V.	Grid L3 V.	Grid kW	Grid kVAr	Grid CosPh	Int.Temp.
18-Feb-2000 07:21:42	0.06	40.00	59.98	277.11	277.06	276.48	0.00	0.00	1.00	33.96
18-Feb-2000 07:11:42	0.55	40.00	59.98	277.06	277.01	276.09	0.00	0.00	1.00	34.03
18-Feb-2000 07:01:42	0.88	40.00	59.98	277.20	277.07	276.23	0.00	0.00	1.00	34.04
18-Feb-2000 06:51:42	1.14	40.00	59.98	276.65	277.32	276.28	0.00	0.00	1.00	34.04
18-Feb-2000 06:41:42	0.22	40.00	59.98	276.51	277.09	276.81	0.00	0.00	1.00	34.03
18-Feb-2000 06:31:42	0.23	40.00	59.98	276.24	277.36	276.54	0.00	0.00	1.00	34.01
18-Feb-2000 06:21:42	0.12	40.00	59.98	276.25	277.00	276.83	0.00	0.00	1.00	34.00
18-Feb-2000 06:11:42	0.07	40.00	59.98	276.49	277.05	276.81	0.00	0.00	1.00	33.97
18-Feb-2000 06:01:42	0.00	40.00	59.98	276.27	277.02	276.78	0.00	0.00	1.00	33.95
18-Feb-2000 05:51:42	0.30	40.00	59.98	276.24	277.11	276.93	0.00	0.00	1.00	33.77
18-Feb-2000 05:41:42	1.27	31.00	59.99	276.12	277.39	276.79	0.00	0.00	1.00	33.86
18-Feb-2000 05:31:42	1.42	14.00	59.98	276.36	277.22	276.99	0.00	0.00	1.00	33.92
18-Feb-2000 05:21:42	2.16	12.00	59.99	276.17	277.61	276.98	0.00	0.00	1.00	33.94
18-Feb-2000 05:11:42	1.82	7.00	59.99	276.60	277.14	276.92	0.00	0.00	1.00	33.97
18-Feb-2000 05:01:42	1.57	4.00	59.99	276.25	277.04	276.96	0.00	0.00	1.00	34.03
18-Feb-2000 04:51:42	1.58	350.00	59.98	276.24	277.40	276.86	0.00	0.00	1.00	34.56
18-Feb-2000 04:41:42	0.98	334.00	59.99	276.60	277.45	276.70	0.00	0.00	1.00	34.99
18-Feb-2000 04:31:42	0.71	257.00	59.98	276.53	277.55	276.29	0.00	0.00	1.00	35.02
18-Feb-2000 04:21:42	0.49	257.00	59.98	276.95	277.66	276.46	0.00	0.00	1.00	35.03
18-Feb-2000 04:11:42	0.37	243.00	59.99	276.72	277.33	276.39	0.00	0.00	1.00	35.03
18-Feb-2000 04:01:42	0.23	241.00	59.99	276.89	277.34	276.67	0.00	0.00	1.00	35.03
18-Feb-2000 03:51:42	0.47	241.00	59.99	276.95	277.70	276.85	0.00	0.00	1.00	35.04
18-Feb-2000 03:41:42	0.57	241.00	59.98	276.86	277.60	276.14	0.00	0.00	1.00	35.04
18-Feb-2000 03:31:42	1.21	241.00	59.99	277.07	277.31	276.38	0.00	0.00	1.00	35.04
18-Feb-2000 03:21:42	0.70	241.00	59.99	277.00	277.33	276.65	0.00	0.00	1.00	35.03
18-Feb-2000 03:11:42	0.76	241.00	59.99	276.78	277.65	276.64	0.00	0.00	1.00	35.01
18-Feb-2000 03:01:42	1.43	241.00	59.99	276.91	277.42	276.39	0.00	0.00	1.00	34.95
18-Feb-2000 02:51:42	0.18	255.00	59.99	276.95	277.63	276.68	0.00	0.00	1.00	34.65
18-Feb-2000 02:41:42	0.00	261.00	59.99	276.99	277.88	276.29	0.00	0.00	1.00	34.94
18-Feb-2000 02:31:42	0.18	261.00	59.99	276.89	277.67	276.79	0.00	0.00	1.00	34.98
18-Feb-2000 02:21:42	0.00	261.00	59.99	277.02	277.54	276.06	0.00	0.00	1.00	35.00
18-Feb-2000 02:11:42	0.00	261.00	59.99	276.99	277.66	276.25	0.00	0.00	1.00	35.03
18-Feb-2000 02:01:42	0.00	261.00	59.98	276.97	277.73	276.51	0.00	0.00	1.00	35.04
18-Feb-2000 01:51:42	0.00	261.00	59.99	277.01	277.65	276.63	0.00	0.00	1.00	35.07
18-Feb-2000 01:41:42	0.00	261.00	59.99	277.03	277.09	276.54	0.00	0.00	1.00	35.26
18-Feb-2000 01:31:42	0.00	261.00	59.99	276.94	277.58	276.18	0.00	0.00	1.00	35.83
18-Feb-2000 01:21:42	0.00	261.00	59.99	277.02	277.53	276.42	0.00	0.00	1.00	35.92
18-Feb-2000 01:11:42	0.04	261.00	59.99	276.85	277.69	276.36	0.00	0.00	1.00	35.93
18-Feb-2000 01:01:42	0.13	261.00	59.99	277.02	277.34	276.55	0.00	0.00	1.00	35.97
18-Feb-2000 00:51:42	0.59	261.00	59.99	277.02	277.45	276.37	0.00	0.00	1.00	36.02
18-Feb-2000 00:41:42	0.10	261.00	59.99	276.98	277.43	276.21	0.00	0.00	1.00	36.03
18-Feb-2000 00:31:42	0.24	261.00	59.99	276.98	277.32	276.52	0.00	0.00	1.00	36.05
18-Feb-2000 00:21:42	0.02	261.00	59.99	277.00	277.65	276.14	0.00	0.00	1.00	36.12
18-Feb-2000 00:11:42	0.06	261.00	59.99	276.98	277.43	276.01	0.00	0.00	1.00	36.57
18-Feb-2000 00:01:42	2.07	261.00	59.99	277.00	277.54	276.22	0.00	0.00	1.00	36.90
17-Feb-2000 23:51:42	2.25	261.00	59.99	276.94	277.48	276.00	0.00	0.00	1.00	36.94
17-Feb-2000 23:41:42	3.28	257.00	59.99	277.27	277.36	276.22	-0.24	1.10	0.63	36.96
17-Feb-2000 23:31:42	4.40	253.00	59.99	277.45	277.96	276.68	7.97	1.42	-0.63	36.96
17-Feb-2000 23:21:42	4.24	251.00	59.99	277.19	277.77	276.74	5.97	1.97	-0.55	36.96
17-Feb-2000 23:11:42	3.70	252.00	59.99	277.00	277.55	276.59	1.58	0.29	0.53	36.96
17-Feb-2000 23:01:42	3.49	252.00	59.99	276.91	277.26	276.39	-0.17	0.90	0.75	36.99
17-Feb-2000 22:51:42	3.89	251.00	59.99	277.14	277.36	276.53	2.08	1.57	0.03	37.00
17-Feb-2000 22:41:42	3.81	251.00	59.99	277.45	277.63	276.68	2.33	1.99	0.02	37.00
17-Feb-2000 22:31:42	3.88	252.00	59.99	277.35	277.41	276.26	0.83	2.24	-0.01	37.01
17-Feb-2000 22:21:42	3.21	257.00	59.99	277.06	277.22	276.01	0.19	1.23	0.59	37.03
17-Feb-2000 22:11:42	2.81	259.00	59.99	276.89	277.38	275.96	-0.06	-0.55	0.97	37.06
17-Feb-2000 22:01:42	2.58	259.00	59.99	276.98	277.12	276.05	0.00	0.00	1.00	37.52
17-Feb-2000 21:51:42	3.55	260.00	59.99	277.08	277.47	276.20	1.25	1.60	0.31	37.93
17-Feb-2000 21:41:42	4.21	260.00	59.99	277.27	277.84	276.53	5.11	2.42	-0.52	37.96
17-Feb-2000 21:31:42	5.06	259.00	59.99	277.06	277.79	276.65	19.38	-1.58	-0.95	37.97
17-Feb-2000 21:21:42	3.73	260.00	59.99	276.82	277.16	276.10	1.85	0.75	0.36	37.99
17-Feb-2000 21:11:42	4.24	259.00	59.98	276.77	277.01	276.71	5.47	2.39	-0.56	38.01
17-Feb-2000 21:01:42	4.51	257.00	59.98	276.94	277.19	276.37	10.11	1.25	-0.78	38.03
17-Feb-2000 20:51:42	5.27	256.00	59.99	277.14	277.38	276.68	22.63	-2.71	-0.96	38.07

WPMS Data Panel: 24h/10min Datalog

Current Park: SCI Wind Turbines
Current Turbine: Turbine 1 (1)

17-Feb-2000 20:41:42	4.73	260.00	59.99	277.99	278.91	277.92	13.40	0.39	-0.85	38.56
17-Feb-2000 20:31:42	4.90	259.00	59.98	278.20	278.95	277.95	15.94	-0.33	-0.90	38.94
17-Feb-2000 20:21:42	4.55	261.00	59.98	277.83	278.79	277.70	9.87	1.27	-0.66	38.98
17-Feb-2000 20:11:42	5.54	261.00	59.98	278.04	278.81	277.98	28.84	-5.11	-0.97	39.01
17-Feb-2000 20:01:42	5.36	262.00	59.98	277.66	277.87	276.81	20.31	-8.14	-0.72	39.07
17-Feb-2000 19:51:42	6.47	260.00	59.98	278.26	278.84	277.51	32.43	-3.20	-0.75	39.66
17-Feb-2000 19:41:42	6.85	259.00	59.98	278.18	278.81	277.69	45.73	-5.70	-0.92	39.95
17-Feb-2000 19:31:42	6.66	259.00	59.98	278.11	278.57	277.69	39.95	-4.57	-0.84	39.99
17-Feb-2000 19:21:42	6.53	259.00	59.99	277.96	278.57	278.67	33.80	-3.23	-0.83	40.02
17-Feb-2000 19:11:42	7.13	262.00	59.97	278.82	279.60	279.88	51.99	-7.10	-0.96	40.09
17-Feb-2000 19:01:42	7.63	254.00	59.97	278.89	279.93	279.74	70.18	-11.12	-0.97	40.84
17-Feb-2000 18:51:42	7.16	250.00	59.97	278.58	279.29	278.69	51.89	-7.00	-0.96	40.97
17-Feb-2000 18:41:42	6.81	251.00	59.97	278.25	279.00	278.52	39.79	-4.41	-0.92	41.01
17-Feb-2000 18:31:42	7.79	249.00	59.98	278.75	279.35	278.76	75.45	-12.23	-0.97	41.04
17-Feb-2000 18:21:42	7.72	249.00	59.97	278.09	279.33	278.48	73.46	-11.78	-0.97	41.50
17-Feb-2000 18:11:42	6.67	257.00	59.98	277.99	279.56	278.17	38.42	-3.82	-0.90	41.97
17-Feb-2000 18:01:42	8.26	253.00	59.98	278.25	278.80	277.84	94.32	-16.80	-0.98	42.02
17-Feb-2000 17:51:42	8.78	252.00	59.98	278.49	278.91	278.21	112.68	-22.17	-0.98	42.06
17-Feb-2000 17:41:42	8.40	255.00	59.98	278.51	278.91	278.47	97.32	-17.63	-0.98	42.66
17-Feb-2000 17:31:42	8.67	256.00	59.98	278.06	278.85	277.94	107.76	-20.84	-0.98	42.95
17-Feb-2000 17:21:42	8.88	259.00	59.98	278.11	278.82	278.44	113.11	-22.38	-0.98	42.97
17-Feb-2000 17:11:42	8.39	259.00	59.98	278.53	278.78	278.15	98.57	-17.89	-0.98	42.98
17-Feb-2000 17:01:42	7.99	263.00	59.98	278.97	278.92	278.82	87.59	-15.12	-0.97	43.00
17-Feb-2000 16:51:42	7.26	263.00	59.98	278.70	278.59	278.84	61.12	-8.20	-0.95	43.02
17-Feb-2000 16:41:42	7.69	261.00	59.98	278.51	278.97	278.91	76.24	-11.74	-0.97	43.04
17-Feb-2000 16:31:42	8.89	260.00	59.98	278.65	278.81	278.71	116.41	-23.66	-0.98	43.09
17-Feb-2000 16:21:42	9.56	260.00	59.98	278.20	278.41	278.11	133.42	-29.25	-0.98	43.21
17-Feb-2000 16:11:42	8.93	265.00	59.98	278.32	278.72	278.51	121.14	-24.95	-0.98	43.69
17-Feb-2000 16:01:42	9.28	261.00	59.98	278.45	278.74	278.11	130.96	-28.14	-0.98	43.90
17-Feb-2000 15:51:42	10.40	261.00	59.99	278.05	278.13	277.83	159.81	-39.27	-0.97	43.91
17-Feb-2000 15:41:42	9.58	263.00	59.98	277.87	277.89	277.54	142.21	-32.44	-0.97	43.91
17-Feb-2000 15:31:42	9.77	262.00	59.98	278.02	278.13	278.22	145.06	-33.46	-0.97	43.93
17-Feb-2000 15:21:42	10.55	259.00	59.98	277.88	277.88	277.80	162.38	-40.33	-0.97	43.96
17-Feb-2000 15:11:42	10.23	257.00	59.98	277.23	277.18	277.31	89.26	-24.97	-0.05	43.94
17-Feb-2000 15:01:42	9.69	261.00	59.98	277.59	277.77	277.46	124.15	-29.49	-0.61	43.96
17-Feb-2000 14:51:42	10.25	261.00	59.99	278.21	278.19	277.22	151.99	-35.93	-0.97	43.96
17-Feb-2000 14:41:42	8.99	271.00	59.98	278.56	278.88	277.34	124.11	-25.76	-0.98	44.00
17-Feb-2000 14:31:42	9.29	268.00	59.98	278.86	278.66	277.89	131.31	-28.52	-0.97	44.00
17-Feb-2000 14:21:42	9.43	266.00	59.98	279.76	279.33	278.22	138.01	-30.85	-0.97	43.96
17-Feb-2000 14:11:42	10.09	259.00	59.97	279.54	279.57	278.27	156.88	-38.21	-0.97	43.93
17-Feb-2000 14:01:42	11.05	259.00	59.97	279.37	279.11	277.88	178.41	-47.19	-0.96	43.75
17-Feb-2000 13:51:42	10.13	261.00	59.97	279.55	279.41	278.18	155.38	-37.38	-0.97	43.19
17-Feb-2000 13:41:42	9.28	263.00	59.97	279.97	279.93	278.34	130.17	-28.17	-0.97	43.10
17-Feb-2000 13:31:42	9.45	272.00	59.99	280.44	280.24	278.90	131.28	-28.23	-0.98	43.08
17-Feb-2000 13:21:42	9.63	267.00	59.98	280.96	280.72	279.78	140.92	-31.89	-0.97	43.07
17-Feb-2000 13:11:42	9.60	267.00	59.98	280.10	280.20	279.33	140.12	-31.84	-0.97	43.07
17-Feb-2000 13:01:42	10.03	266.00	59.98	280.41	279.96	279.02	152.16	-36.32	-0.97	43.06
17-Feb-2000 12:51:42	10.17	272.00	59.98	280.88	279.94	279.39	154.79	-37.23	-0.97	43.04
17-Feb-2000 12:41:42	9.54	273.00	59.98	281.02	280.28	279.63	133.94	-29.49	-0.97	43.04
17-Feb-2000 12:31:42	9.45	267.00	59.98	281.13	280.81	279.80	135.09	-29.90	-0.97	43.03
17-Feb-2000 12:21:42	9.81	263.00	59.98	281.01	280.23	279.61	144.43	-33.20	-0.97	43.03
17-Feb-2000 12:11:42	10.10	266.00	59.98	281.37	280.18	279.91	154.43	-36.94	-0.97	43.02
17-Feb-2000 12:01:42	10.15	263.00	59.98	280.99	280.53	279.98	158.69	-38.58	-0.97	43.01
17-Feb-2000 11:51:42	10.48	262.00	59.98	281.23	280.45	279.98	163.73	-40.67	-0.97	42.99
17-Feb-2000 11:41:42	9.82	262.00	59.98	280.94	280.49	279.96	146.78	-34.19	-0.97	42.97
17-Feb-2000 11:31:42	10.13	263.00	59.98	280.99	280.53	279.98	155.36	-37.43	-0.97	42.96
17-Feb-2000 11:21:42	10.03	264.00	59.98	281.04	280.70	279.96	152.77	-36.27	-0.97	42.93
17-Feb-2000 11:11:42	10.42	265.00	59.98	280.99	280.65	279.97	163.25	-40.39	-0.97	42.74
17-Feb-2000 11:01:42	11.01	260.00	59.98	280.96	280.67	279.83	174.30	-45.15	-0.97	42.14
17-Feb-2000 10:51:42	10.79	259.00	59.98	280.54	280.17	279.75	173.56	-44.65	-0.97	42.04
17-Feb-2000 10:41:42	10.64	256.00	59.98	280.77	280.44	279.74	170.17	-43.34	-0.97	42.02
17-Feb-2000 10:31:42	10.69	262.00	59.98	280.91	280.30	279.25	170.32	-43.46	-0.97	41.99
17-Feb-2000 10:21:42	10.85	264.00	59.98	280.67	280.70	279.02	176.36	-46.05	-0.97	41.97
17-Feb-2000 10:11:42	10.77	263.00	59.98	280.94	280.67	279.65	171.11	-43.70	-0.97	41.94
17-Feb-2000 10:01:42	10.54	266.00	60.00	280.89	280.70	279.92	167.41	-41.98	-0.97	41.73

WPMS Data Panel: 24h/10min Datalog

18-Feb-20

Current Park: SCI Wind Turbines
Current Turbine: Turbine 1 (1)

17-Feb-2000 09:51:42	10.72	265.00	60.00	280.88	280.91	279.71	172.13	-44.09	-0.97	41.13
17-Feb-2000 09:41:42	11.05	265.00	60.00	280.71	280.88	279.43	181.50	-48.22	-0.97	41.04
17-Feb-2000 09:31:42	10.83	266.00	60.00	280.39	280.60	279.20	175.51	-45.78	-0.97	41.02
17-Feb-2000 09:21:42	10.91	266.00	60.00	280.29	280.75	279.09	178.05	-46.84	-0.97	41.00
17-Feb-2000 09:11:42	10.94	266.00	60.00	280.19	280.89	279.18	176.72	-46.27	-0.97	40.98
17-Feb-2000 09:01:42	10.79	265.00	60.00	280.13	280.64	279.13	175.62	-45.73	-0.97	40.95
17-Feb-2000 08:51:42	11.32	264.00	60.00	280.17	280.34	278.87	188.26	-51.43	-0.97	40.88
17-Feb-2000 08:41:42	11.81	265.00	60.00	279.66	280.05	278.88	198.82	-56.46	-0.96	40.21
17-Feb-2000 08:31:42	11.61	265.00	60.00	279.17	280.04	278.90	195.43	-54.76	-0.96	40.04
17-Feb-2000 08:21:42	11.22	265.00	60.00	279.71	280.12	278.87	182.40	-48.58	-0.97	40.02
17-Feb-2000 08:11:42	11.50	268.00	60.00	279.07	280.38	278.65	185.03	-49.70	-0.97	39.99
17-Feb-2000 08:01:42	11.19	268.00	60.00	279.22	280.01	278.96	179.89	-47.41	-0.97	39.97
17-Feb-2000 07:51:42	10.18	268.00	60.00	279.64	280.57	279.18	153.48	-36.60	-0.97	39.96
17-Feb-2000 07:41:42	10.67	266.00	60.00	280.80	280.97	279.44	169.28	-42.65	-0.97	39.94
17-Feb-2000 07:31:42	10.78	266.00	60.00	280.59	280.69	279.63	171.98	-43.63	-0.97	39.91

WPMS Data Panel: 24h/10min Datalog

22-Feb-20

Current Park: SCI Wind Turbines
Current Turbine: Turbine 1 (1)

	Windspeed	Winddir.	Grid Freq.	Grid L1 V.	Grid L2 V.	Grid L3 V.	Grid kW	Grid kVAr	Grid CosPh	Int.Temp.
22-Feb-2000 09:35:49	2.95	206.00	60.00	277.03	277.64	276.97	0.00	0.00	1.00	38.01
22-Feb-2000 09:25:49	3.01	199.00	60.00	277.23	277.63	276.99	-1.09	-0.24	0.92	38.00
22-Feb-2000 09:15:49	3.15	189.00	60.00	277.10	277.27	277.08	0.00	0.00	1.00	37.99
22-Feb-2000 09:05:49	3.17	194.00	60.00	276.95	277.30	277.15	-0.67	-0.24	0.90	37.99
22-Feb-2000 08:55:49	3.20	190.00	60.00	277.21	277.27	277.05	0.00	0.00	1.00	37.98
22-Feb-2000 08:45:49	4.02	180.00	60.00	277.38	277.07	277.59	3.69	1.56	-0.10	37.95
22-Feb-2000 08:35:49	4.53	182.00	60.00	277.55	277.64	277.12	10.64	0.58	-0.79	37.56
22-Feb-2000 08:25:49	4.20	188.00	60.00	277.69	276.99	276.94	8.31	-1.11	-0.03	37.07
22-Feb-2000 08:15:49	2.99	216.00	60.00	277.11	277.09	277.41	0.00	0.00	1.00	37.07
22-Feb-2000 08:05:49	3.05	229.00	60.00	277.40	277.02	277.37	-0.24	0.19	0.96	37.07
22-Feb-2000 07:55:49	4.46	247.00	59.99	277.75	277.22	277.51	6.45	1.61	-0.55	37.06
22-Feb-2000 07:45:49	4.88	254.00	59.98	277.95	277.63	277.75	14.88	-0.65	-0.88	37.04
22-Feb-2000 07:35:49	5.09	256.00	59.97	277.60	277.55	277.38	20.11	-2.28	-0.95	37.03
22-Feb-2000 07:25:49	5.10	257.00	59.97	277.63	277.91	277.52	18.81	-1.84	-0.94	37.03
22-Feb-2000 07:15:49	4.68	262.00	59.97	277.94	277.45	277.88	12.42	-0.13	-0.68	37.03
22-Feb-2000 07:05:49	4.32	261.00	59.97	277.79	277.80	277.47	6.30	0.73	-0.39	37.03
22-Feb-2000 06:55:49	3.69	258.00	59.98	276.24	276.05	276.33	0.44	0.87	0.64	37.03
22-Feb-2000 06:45:49	4.29	260.00	59.97	276.74	275.85	276.75	4.85	2.11	-0.44	37.05
22-Feb-2000 06:35:49	3.81	263.00	59.97	276.34	275.88	276.89	0.20	1.21	0.43	37.08
22-Feb-2000 06:25:49	3.97	264.00	59.97	276.42	276.00	276.98	2.64	1.93	-0.03	37.24
22-Feb-2000 06:15:49	4.03	264.00	59.97	276.67	276.14	276.51	1.27	2.98	-0.14	37.56
22-Feb-2000 06:05:49	3.96	264.00	59.97	276.56	276.31	275.83	0.57	2.17	0.05	37.82
22-Feb-2000 05:55:49	4.08	264.00	59.97	276.04	276.46	275.41	1.98	2.79	-0.21	37.92
22-Feb-2000 05:45:49	4.59	264.00	59.97	276.03	276.19	276.09	9.77	1.00	-0.74	37.93
22-Feb-2000 05:35:49	4.58	265.00	59.97	276.39	276.08	276.38	10.09	0.95	-0.76	37.94
22-Feb-2000 05:25:49	4.32	262.00	59.97	276.60	276.02	275.81	5.67	2.06	-0.53	37.95
22-Feb-2000 05:15:49	3.84	256.00	59.97	275.97	275.96	275.38	2.38	0.65	0.27	37.95
22-Feb-2000 05:05:49	3.90	261.00	59.97	275.89	275.93	274.95	1.57	2.16	0.05	37.97
22-Feb-2000 04:55:49	4.48	265.00	59.98	276.03	276.64	275.09	8.31	1.34	-0.67	37.98
22-Feb-2000 04:45:49	4.69	265.00	59.98	276.12	276.24	275.55	11.84	-0.86	-0.78	37.99
22-Feb-2000 04:35:49	5.76	262.00	59.98	276.70	276.57	275.81	12.18	-5.12	-0.44	37.99
22-Feb-2000 04:25:49	6.21	263.00	59.98	276.58	276.98	276.01	20.59	-1.93	-0.74	37.98
22-Feb-2000 04:15:49	6.36	261.00	59.98	276.75	277.08	276.39	24.45	-2.63	-0.79	37.98
22-Feb-2000 04:05:49	6.20	264.00	59.98	276.23	276.50	275.77	20.17	-7.92	-0.64	37.97
22-Feb-2000 03:55:49	5.71	264.00	59.98	275.97	276.14	275.26	28.07	-11.67	-0.84	37.98
22-Feb-2000 03:45:49	5.86	263.00	59.98	276.88	276.82	276.03	12.02	-0.46	-0.46	37.96
22-Feb-2000 03:35:49	6.29	261.00	59.98	276.90	276.83	276.63	24.65	-2.55	-0.81	37.96
22-Feb-2000 03:25:49	6.08	262.00	59.98	276.61	276.54	275.89	27.01	-11.14	-0.74	37.96
22-Feb-2000 03:15:49	5.55	262.00	59.98	276.45	276.17	275.62	28.52	-5.45	-0.96	37.97
22-Feb-2000 03:05:49	5.70	262.00	59.98	276.15	276.27	275.56	21.61	-9.78	-0.67	37.98
22-Feb-2000 02:55:49	6.11	264.00	59.98	276.72	277.25	276.24	17.53	-1.54	-0.66	37.97
22-Feb-2000 02:45:49	6.44	263.00	59.98	277.23	276.99	276.53	28.42	-3.41	-0.85	37.97
22-Feb-2000 02:35:49	6.25	261.00	59.98	276.94	276.98	276.55	21.51	-2.26	-0.73	37.97
22-Feb-2000 02:25:49	6.33	264.00	59.98	276.82	277.02	276.61	24.88	-2.81	-0.83	37.96
22-Feb-2000 02:15:49	6.49	262.00	59.98	277.42	277.33	276.77	31.30	-3.95	-0.87	37.96
22-Feb-2000 02:05:49	6.58	263.00	59.98	277.55	277.33	277.11	34.10	-4.45	-0.90	37.96
22-Feb-2000 01:55:49	6.72	259.00	59.98	277.10	277.31	276.86	36.72	-4.86	-0.91	37.95
22-Feb-2000 01:45:49	6.29	263.00	59.98	276.90	277.08	276.35	22.33	-2.20	-0.76	37.94
22-Feb-2000 01:35:49	6.07	265.00	59.98	276.64	276.60	275.95	25.07	-10.72	-0.73	37.95
22-Feb-2000 01:25:49	5.63	264.00	59.98	276.31	276.28	275.90	28.35	-5.38	-0.96	37.96
22-Feb-2000 01:15:49	5.30	268.00	59.98	276.12	276.10	276.01	21.06	-2.62	-0.92	37.96
22-Feb-2000 01:05:49	5.35	269.00	59.98	276.40	276.02	275.53	23.27	-3.38	-0.94	37.97
22-Feb-2000 00:55:49	5.60	271.00	59.98	276.25	276.49	275.78	28.47	-5.38	-0.96	37.98
22-Feb-2000 00:45:49	5.39	271.00	59.98	276.46	276.60	275.47	24.38	-3.75	-0.95	37.99
22-Feb-2000 00:35:49	5.04	273.00	59.98	276.18	276.24	275.47	18.26	-1.52	-0.93	37.99
22-Feb-2000 00:25:49	4.95	273.00	59.98	276.54	276.16	275.87	16.90	-1.14	-0.89	38.00
22-Feb-2000 00:15:49	5.04	273.00	59.98	276.57	276.27	275.45	17.79	-1.53	-0.89	38.01
22-Feb-2000 00:05:49	5.25	274.00	59.98	276.92	276.21	275.65	22.23	-2.93	-0.95	38.02
21-Feb-2000 23:55:49	5.08	273.00	59.98	276.15	276.33	275.70	19.80	-2.08	-0.94	38.03
21-Feb-2000 23:45:49	5.39	272.00	59.98	276.33	276.50	275.36	15.04	-6.96	-0.64	38.04
21-Feb-2000 23:35:49	5.99	271.00	59.98	277.28	276.71	276.19	16.19	-1.18	-0.59	38.04
21-Feb-2000 23:25:49	6.20	271.00	59.98	277.46	276.94	276.61	20.09	-1.84	-0.71	38.04
21-Feb-2000 23:15:49	6.47	272.00	59.98	277.29	277.34	276.56	29.13	-3.42	-0.80	38.05
21-Feb-2000 23:05:49	6.75	271.00	59.98	277.64	277.57	276.57	38.07	-5.06	-0.88	38.06

WPMS Data Panel: 24h/10min Datalog

Current Park: SCI Wind Turbines
Current Turbine: Turbine 1 (1)

21-Feb-2000 22:55:49	6.85	271.00	59.98	277.78	277.36	276.75	43.80	-6.06	-0.94	38.06
21-Feb-2000 22:45:49	7.14	264.00	59.98	277.82	277.32	276.89	50.84	-7.59	-0.94	38.05
21-Feb-2000 22:35:49	6.87	263.00	59.98	278.01	277.20	276.97	42.71	-5.64	-0.94	38.03
21-Feb-2000 22:25:49	6.38	264.00	59.98	277.02	276.60	275.97	37.15	-13.54	-0.90	38.05
21-Feb-2000 22:15:49	5.65	264.00	59.98	277.14	276.31	275.85	29.66	-5.75	-0.97	38.10
21-Feb-2000 22:05:49	5.14	261.00	59.98	276.65	276.02	275.98	20.09	-2.08	-0.93	38.55
21-Feb-2000 21:55:49	4.97	262.00	59.99	276.39	275.99	275.63	17.12	-1.21	-0.88	38.93
21-Feb-2000 21:45:49	5.58	260.00	59.99	276.40	276.02	275.89	29.30	-5.52	-0.97	38.96
21-Feb-2000 21:35:49	5.05	260.00	59.99	276.57	276.30	275.26	19.65	-1.85	-0.94	38.98
21-Feb-2000 21:25:49	4.86	261.00	59.99	276.84	276.15	275.29	15.12	-0.30	-0.90	38.99
21-Feb-2000 21:15:49	4.98	262.00	59.99	276.16	276.03	275.24	18.27	-1.34	-0.93	39.01
21-Feb-2000 21:05:49	5.48	261.00	59.99	276.59	276.08	275.46	27.26	-4.67	-0.96	39.02
21-Feb-2000 20:55:49	4.66	245.00	59.99	276.79	276.00	275.59	12.94	0.37	-0.85	39.03
21-Feb-2000 20:45:49	5.10	237.00	59.99	276.60	276.09	275.75	20.78	-2.10	-0.95	39.06
21-Feb-2000 20:35:49	5.27	238.00	59.99	275.99	275.99	275.21	24.04	-3.37	-0.96	39.32
21-Feb-2000 20:25:49	5.04	250.00	59.99	276.23	276.01	275.88	18.73	-1.53	-0.92	39.90
21-Feb-2000 20:15:49	4.77	246.00	59.99	276.43	275.94	275.77	14.21	-0.03	-0.87	39.96
21-Feb-2000 20:05:49	5.67	245.00	59.99	276.30	275.87	275.59	14.03	-6.50	-0.47	39.97
21-Feb-2000 19:55:49	5.92	242.00	59.99	276.65	276.20	276.06	16.92	-0.87	-0.59	39.98
21-Feb-2000 19:45:49	5.82	245.00	59.99	275.71	275.87	275.52	21.23	-9.37	-0.62	39.99
21-Feb-2000 19:35:49	5.27	241.00	59.99	275.94	276.11	275.46	24.23	-3.33	-0.96	40.01
21-Feb-2000 19:25:49	5.16	234.00	59.98	275.89	275.72	275.64	21.93	-8.39	-0.90	40.03
21-Feb-2000 19:15:49	5.79	233.00	60.04	277.02	276.94	276.54	12.67	0.46	-0.51	40.06
21-Feb-2000 19:05:49	6.09	231.00	60.12	277.10	277.37	277.62	22.13	-0.72	-0.74	40.12
21-Feb-2000 18:55:49	6.81	232.00	60.10	278.04	277.93	277.57	42.85	-4.50	-0.95	40.62
21-Feb-2000 18:45:49	7.42	232.00	60.08	278.59	278.06	277.89	62.40	-8.65	-0.98	40.92
21-Feb-2000 18:35:49	7.35	224.00	60.05	278.50	278.11	277.89	58.36	-7.97	-0.97	40.96
21-Feb-2000 18:25:49	7.33	221.00	60.01	278.10	277.98	277.98	57.74	-7.97	-0.97	40.97
21-Feb-2000 18:15:49	7.36	213.00	59.98	277.90	277.96	278.27	58.74	-8.17	-0.97	40.98
21-Feb-2000 18:05:49	7.27	212.00	60.00	278.36	278.08	278.22	57.31	-7.47	-0.97	40.99
21-Feb-2000 17:55:49	7.41	213.00	59.97	278.22	278.56	278.44	62.84	-8.76	-0.97	41.00
21-Feb-2000 17:45:49	7.28	224.00	59.97	278.96	278.65	277.85	58.62	-8.06	-0.94	41.00
21-Feb-2000 17:35:49	7.56	223.00	59.97	278.97	278.86	278.33	68.72	-10.12	-0.97	41.01
21-Feb-2000 17:25:49	8.42	226.00	59.98	278.67	278.68	278.50	96.14	-17.48	-0.98	41.01
21-Feb-2000 17:15:49	8.24	226.00	59.98	278.78	278.65	278.06	92.80	-16.59	-0.98	41.01
21-Feb-2000 17:05:49	8.07	227.00	59.98	278.50	278.72	278.47	84.11	-13.94	-0.98	41.02
21-Feb-2000 16:55:49	9.13	227.00	59.98	278.74	278.92	278.60	121.62	-25.28	-0.98	41.02
21-Feb-2000 16:45:49	10.02	228.00	59.98	278.83	278.53	278.04	146.25	-33.97	-0.97	41.01
21-Feb-2000 16:35:49	8.82	226.00	59.98	278.74	278.21	278.36	105.90	-20.24	-0.98	40.99
21-Feb-2000 16:25:49	9.01	227.00	59.98	279.01	278.06	278.51	117.54	-23.66	-0.98	40.99
21-Feb-2000 16:15:49	8.79	226.00	59.98	279.04	278.35	278.61	104.62	-19.67	-0.98	40.97
21-Feb-2000 16:05:49	8.80	226.00	59.98	278.90	278.08	278.10	103.34	-19.23	-0.98	40.96
21-Feb-2000 15:55:49	8.41	228.00	59.98	279.28	278.31	278.52	99.20	-17.96	-0.98	40.95
21-Feb-2000 15:45:49	8.96	227.00	59.98	279.02	278.11	277.87	112.00	-22.10	-0.98	40.92
21-Feb-2000 15:35:49	9.21	228.00	59.98	279.01	277.83	277.61	123.75	-25.59	-0.98	40.57
21-Feb-2000 15:25:49	9.80	226.00	59.98	279.00	277.76	278.03	139.15	-31.04	-0.98	40.09
21-Feb-2000 15:15:49	9.99	223.00	59.98	278.93	277.88	277.82	148.18	-34.50	-0.97	40.03
21-Feb-2000 15:05:49	9.32	222.00	59.96	278.70	278.29	278.01	127.30	-26.99	-0.98	40.02
21-Feb-2000 14:55:49	9.11	221.00	59.96	278.94	278.01	278.48	121.53	-24.82	-0.98	40.00
21-Feb-2000 14:45:49	9.16	219.00	59.95	278.28	277.63	277.42	114.40	-27.05	-0.75	40.00
21-Feb-2000 14:35:49	8.23	220.00	54.16	231.58	231.99	231.76	58.04	-12.45	0.13	40.02
21-Feb-2000 14:25:49	9.69	222.00	59.96	278.33	278.33	277.99	140.91	-31.51	-0.98	40.03
21-Feb-2000 14:15:49	10.33	221.00	59.96	278.57	278.22	277.92	158.28	-38.28	-0.97	40.01
21-Feb-2000 14:05:49	10.29	221.00	59.96	278.90	278.35	278.24	154.26	-36.50	-0.97	40.00
21-Feb-2000 13:55:49	10.02	221.00	59.96	278.82	278.18	277.93	150.72	-35.13	-0.97	40.00
21-Feb-2000 13:45:49	9.67	218.00	59.96	278.96	278.33	278.23	141.99	-31.90	-0.98	40.01
21-Feb-2000 13:35:49	9.15	216.00	59.96	279.21	278.47	278.09	124.91	-25.60	-0.98	40.03
21-Feb-2000 13:25:49	9.96	216.00	59.96	278.72	278.36	278.12	145.06	-33.35	-0.97	40.07
21-Feb-2000 13:15:49	9.33	230.00	59.97	278.84	278.34	278.30	128.21	-26.66	-0.98	40.65
21-Feb-2000 13:05:49	9.72	234.00	59.99	279.01	278.48	278.80	141.27	-31.28	-0.98	40.96
21-Feb-2000 12:55:49	10.77	228.00	59.99	278.82	278.18	277.94	162.44	-39.95	-0.97	41.00
21-Feb-2000 12:45:49	13.01	235.00	60.00	277.76	277.41	277.11	212.52	-63.44	-0.96	41.01
21-Feb-2000 12:35:49	11.21	240.00	59.99	278.59	278.37	277.78	172.39	-44.67	-0.97	41.02
21-Feb-2000 12:25:49	13.37	201.00	60.00	278.09	277.57	276.78	210.02	-62.58	-0.96	41.03
21-Feb-2000 12:15:49	10.00	190.00	59.99	278.60	278.42	277.42	137.69	-33.01	-0.96	41.05

WPMS Data Panel: 24h/10min Datalog

22-Feb-20

Current Park: SCI Wind Turbines
Current Turbine: Turbine 1 (1)

21-Feb-2000 12:05:49	10.97	197.00	59.99	278.50	277.95	277.23	166.43	-41.60	-0.97	41.13
21-Feb-2000 11:55:49	11.61	189.00	59.98	278.61	277.73	277.08	177.27	-46.81	-0.97	41.66
21-Feb-2000 11:45:49	12.48	186.00	59.99	279.29	277.97	277.93	200.19	-57.74	-0.96	41.85
21-Feb-2000 11:35:49	11.46	192.00	59.99	278.93	277.98	278.00	180.28	-48.67	-0.97	41.92
21-Feb-2000 11:25:49	12.73	192.00	59.99	279.16	277.95	277.85	208.77	-61.97	-0.96	41.94
21-Feb-2000 11:15:49	13.06	196.00	59.99	278.94	277.52	277.53	213.93	-65.07	-0.96	41.93
21-Feb-2000 11:05:49	13.03	193.00	60.00	278.98	277.38	277.94	206.40	-61.14	-0.96	41.92
21-Feb-2000 10:55:49	12.37	181.00	60.00	279.21	277.89	278.04	199.88	-57.50	-0.96	41.92
21-Feb-2000 10:45:49	11.62	186.00	59.99	278.87	277.92	277.81	181.62	-49.48	-0.97	41.92
21-Feb-2000 10:35:49	11.25	187.00	59.99	279.27	278.26	278.24	173.86	-45.93	-0.97	41.94
21-Feb-2000 10:25:49	11.16	190.00	59.99	278.66	278.19	277.53	175.75	-47.00	-0.97	41.96
21-Feb-2000 10:15:49	12.97	192.00	60.00	279.01	278.13	277.65	214.26	-65.24	-0.96	41.95
21-Feb-2000 10:05:49	13.18	193.00	60.00	279.05	277.98	277.57	214.74	-65.52	-0.96	41.77
21-Feb-2000 09:55:49	12.11	192.00	60.00	279.00	278.26	278.11	194.42	-55.53	-0.96	41.12
21-Feb-2000 09:45:49	12.90	193.00	60.00	278.75	277.95	277.68	210.13	-63.30	-0.96	41.04

WPMS Data Panel: 24h/10min Datalog

22-Feb-20

Current Park: SCI Wind Turbines
Current Turbine: Turbine 2 (2)

	Windspeed	Winddir.	Grid Freq.	Grid L1 V.	Grid L2 V.	Grid L3 V.	Grid kW	Grid kVAr	Grid CosPh	Int.Temp.
22-Feb-2000 09:40:09	2.61	196.00	60.00	277.00	277.26	276.97	0.00	0.00	1.00	39.98
22-Feb-2000 09:30:09	2.42	196.00	60.00	277.10	277.12	276.91	0.00	0.00	1.00	39.97
22-Feb-2000 09:20:09	3.02	186.00	60.00	277.02	277.04	276.98	0.00	0.00	1.00	39.97
22-Feb-2000 09:10:09	3.44	171.00	60.00	276.94	276.95	276.99	-0.62	-0.05	0.82	39.97
22-Feb-2000 09:00:09	3.13	172.00	60.00	277.01	277.08	277.02	0.00	0.00	1.00	39.97
22-Feb-2000 08:50:09	3.72	171.00	60.00	277.25	276.99	277.15	0.53	1.10	0.50	39.96
22-Feb-2000 08:40:09	4.63	170.00	60.00	277.32	277.23	277.37	11.00	0.24	-0.81	39.90
22-Feb-2000 08:30:09	4.65	169.00	60.00	277.89	277.19	276.97	12.27	-1.12	-0.67	39.38
22-Feb-2000 08:20:09	3.04	184.00	60.00	277.12	276.99	276.95	0.00	0.00	1.00	39.35
22-Feb-2000 08:10:09	3.16	209.00	60.00	277.17	277.00	277.30	0.00	0.00	1.00	39.72
22-Feb-2000 08:00:09	3.81	233.00	60.00	277.41	276.99	277.25	0.33	1.57	0.31	39.71
22-Feb-2000 07:50:09	4.74	242.00	59.98	277.93	277.35	277.62	11.01	0.22	-0.79	39.22
22-Feb-2000 07:40:09	5.08	248.00	59.98	277.73	277.37	277.40	16.09	-1.24	-0.90	39.08
22-Feb-2000 07:30:09	5.07	249.00	59.97	277.45	277.94	277.14	16.99	-1.52	-0.91	39.05
22-Feb-2000 07:20:09	5.01	250.00	59.97	277.94	277.53	277.90	17.16	-1.55	-0.90	39.04
22-Feb-2000 07:10:09	4.34	254.00	59.97	277.82	277.36	277.55	4.90	1.64	-0.41	39.03
22-Feb-2000 07:00:09	3.69	253.00	59.98	276.79	276.68	276.54	0.40	0.16	0.68	39.06
22-Feb-2000 06:50:09	4.01	252.00	59.97	276.47	275.61	276.47	2.04	2.12	-0.11	39.08
22-Feb-2000 06:40:09	3.88	253.00	59.97	276.68	275.82	276.84	0.34	1.47	0.06	39.12
22-Feb-2000 06:30:09	3.57	253.00	59.97	276.09	275.78	276.84	0.18	1.01	0.62	39.75
22-Feb-2000 06:20:09	4.03	254.00	59.97	276.32	276.01	276.77	2.47	2.40	-0.24	39.91
22-Feb-2000 06:10:09	3.92	253.00	59.97	276.88	276.05	276.02	0.55	2.80	-0.06	39.92
22-Feb-2000 06:00:09	3.92	253.00	59.97	276.01	276.17	275.23	0.32	1.98	0.08	39.94
22-Feb-2000 05:50:09	4.31	254.00	59.97	275.97	276.15	275.62	5.51	1.76	-0.49	39.96
22-Feb-2000 05:40:09	4.53	257.00	59.97	276.36	276.06	276.43	10.38	0.60	-0.78	39.96
22-Feb-2000 05:30:09	4.36	257.00	59.97	276.51	276.00	275.92	7.03	1.46	-0.62	39.97
22-Feb-2000 05:20:09	4.18	255.00	59.97	276.08	275.91	275.54	4.11	1.34	-0.28	39.98
22-Feb-2000 05:10:09	3.73	258.00	59.97	275.84	275.76	274.85	0.49	1.25	0.48	39.99
22-Feb-2000 05:00:09	4.25	255.00	59.97	275.93	276.30	274.99	5.95	1.67	-0.55	40.00
22-Feb-2000 04:50:09	4.65	255.00	59.98	276.02	276.36	275.25	11.30	0.28	-0.79	40.02
22-Feb-2000 04:40:09	5.33	258.00	59.98	276.37	276.06	275.66	10.92	-6.24	-0.51	40.03
22-Feb-2000 04:30:09	6.10	253.00	59.98	276.70	276.98	276.02	16.92	-2.11	-0.63	40.02
22-Feb-2000 04:20:09	6.30	253.00	59.98	276.73	277.05	276.27	22.46	-3.05	-0.75	40.01
22-Feb-2000 04:10:09	6.07	253.00	59.98	276.37	276.62	276.04	15.21	-7.90	-0.53	40.00
22-Feb-2000 04:00:09	5.81	253.00	59.98	276.04	276.38	275.32	32.05	-7.30	-0.96	40.01
22-Feb-2000 03:50:09	5.68	257.00	59.98	276.40	276.20	275.69	17.03	-8.54	-0.56	40.01
22-Feb-2000 03:40:09	6.09	255.00	59.98	277.01	277.01	276.65	17.35	-2.08	-0.61	40.00
22-Feb-2000 03:30:09	5.87	251.00	59.98	276.62	276.57	275.99	29.10	-11.93	-0.85	40.00
22-Feb-2000 03:20:09	5.69	251.00	59.98	276.57	276.27	275.57	30.14	-6.54	-0.95	40.01
22-Feb-2000 03:10:09	5.48	252.00	59.98	276.21	276.00	275.60	27.05	-7.79	-0.93	40.03
22-Feb-2000 03:00:09	5.91	254.00	59.98	276.25	276.94	275.98	11.88	-4.54	-0.44	40.02
22-Feb-2000 02:50:09	6.16	252.00	59.98	277.14	277.12	276.49	19.41	-2.73	-0.65	40.02
22-Feb-2000 02:40:09	6.23	253.00	59.98	277.22	276.96	276.57	18.84	-2.66	-0.65	40.02
22-Feb-2000 02:30:09	6.17	255.00	59.98	276.62	276.99	276.50	19.66	-2.77	-0.68	40.02
22-Feb-2000 02:20:09	6.47	252.00	59.98	277.47	277.41	276.92	29.93	-4.50	-0.84	40.02
22-Feb-2000 02:10:09	6.48	251.00	59.98	277.41	277.33	276.81	27.90	-4.16	-0.82	40.02
22-Feb-2000 02:00:09	6.73	247.00	59.98	277.43	277.51	277.16	33.88	-5.15	-0.87	40.02
22-Feb-2000 01:50:09	6.50	252.00	59.98	276.91	277.33	276.59	28.77	-4.18	-0.81	40.01
22-Feb-2000 01:40:09	5.98	257.00	59.98	276.58	276.50	275.81	15.61	-8.48	-0.54	40.00
22-Feb-2000 01:30:09	5.69	255.00	59.98	276.66	276.54	276.06	29.98	-6.23	-0.96	40.00
22-Feb-2000 01:20:09	5.32	255.00	59.98	276.06	276.16	275.96	22.48	-3.44	-0.92	40.01
22-Feb-2000 01:10:09	5.39	256.00	59.98	276.15	276.06	275.82	24.63	-4.12	-0.95	40.02
22-Feb-2000 01:00:09	5.35	257.00	59.98	276.44	276.31	275.57	23.66	-3.95	-0.91	40.03
22-Feb-2000 00:50:09	5.45	257.00	59.98	276.50	276.52	275.71	25.33	-4.37	-0.95	40.02
22-Feb-2000 00:40:09	5.10	267.00	59.98	276.09	276.33	275.23	16.91	-1.35	-0.90	40.03
22-Feb-2000 00:30:09	5.06	269.00	59.98	276.62	276.16	275.85	19.30	-2.13	-0.92	40.04
22-Feb-2000 00:20:09	5.14	269.00	59.98	276.27	276.24	275.46	20.39	-2.61	-0.92	40.07
22-Feb-2000 00:10:09	5.11	269.00	59.98	276.86	276.24	275.52	20.04	-2.36	-0.93	40.12
22-Feb-2000 00:00:09	5.28	269.00	59.98	276.47	276.31	275.71	23.35	-3.61	-0.95	40.51
21-Feb-2000 23:50:09	5.00	269.00	59.98	275.94	276.05	275.24	16.11	-7.00	-0.82	40.91
21-Feb-2000 23:40:09	5.97	269.00	59.98	277.17	276.90	276.12	14.04	-1.64	-0.50	40.91
21-Feb-2000 23:30:09	6.16	269.00	59.98	277.39	276.72	276.41	19.23	-2.58	-0.65	40.91
21-Feb-2000 23:20:09	6.18	268.00	59.98	277.40	277.09	276.54	20.36	-2.77	-0.64	40.92
21-Feb-2000 23:10:09	6.75	263.00	59.98	277.52	277.86	276.75	35.64	-5.42	-0.89	40.90

WPMS Data Panel: 24h/10min Datalog

22-Feb-20

Current Park: SCI Wind Turbines
Current Turbine: Turbine 2 (2)

21-Feb-2000 23:00:09	6.68	257.00	59.98	277.68	277.37	276.72	35.10	-5.28	-0.89	40.88
21-Feb-2000 22:50:09	7.26	257.00	59.98	277.96	277.79	276.91	54.01	-9.05	-0.95	40.81
21-Feb-2000 22:40:09	6.73	257.00	59.98	277.89	277.25	276.95	36.51	-5.50	-0.87	40.53
21-Feb-2000 22:30:09	6.65	257.00	59.98	277.35	276.94	276.31	34.92	-11.39	-0.82	40.29
21-Feb-2000 22:20:09	5.82	257.00	59.98	277.20	276.66	275.93	32.60	-7.32	-0.96	40.71
21-Feb-2000 22:10:09	5.42	257.00	59.98	276.79	276.02	275.91	24.96	-4.37	-0.93	40.91
21-Feb-2000 22:00:09	4.86	257.00	59.99	276.44	275.99	275.57	14.13	-0.41	-0.86	40.94
21-Feb-2000 21:50:09	5.32	255.00	59.99	276.30	276.00	275.92	23.21	-3.42	-0.95	40.96
21-Feb-2000 21:40:09	5.14	254.00	59.99	276.39	276.26	275.33	19.54	-2.17	-0.92	40.98
21-Feb-2000 21:30:09	4.81	256.00	59.99	276.89	276.10	275.27	13.29	-0.07	-0.86	41.00
21-Feb-2000 21:20:09	4.77	257.00	59.99	276.39	276.00	275.22	13.81	-0.23	-0.87	41.00
21-Feb-2000 21:10:09	5.28	255.00	59.99	276.40	276.05	275.40	22.68	-3.14	-0.95	41.01
21-Feb-2000 21:00:09	4.99	241.00	59.99	276.68	276.01	275.43	17.03	-1.37	-0.87	41.01
21-Feb-2000 20:50:09	5.02	227.00	59.99	276.73	276.02	275.71	16.09	-0.90	-0.88	41.02
21-Feb-2000 20:40:09	5.22	227.00	59.99	276.19	276.03	275.27	20.07	-2.16	-0.94	41.03
21-Feb-2000 20:30:09	5.20	232.00	59.98	275.96	275.99	275.64	21.62	-2.88	-0.91	41.06
21-Feb-2000 20:20:09	4.93	234.00	59.98	276.46	275.96	275.83	15.97	-0.80	-0.89	41.11
21-Feb-2000 20:10:09	5.09	233.00	59.98	276.15	275.79	275.52	19.68	-2.14	-0.89	41.64
21-Feb-2000 20:00:09	5.51	231.00	59.99	276.64	276.20	276.00	28.26	-5.28	-0.96	41.92
21-Feb-2000 19:50:09	5.42	231.00	59.98	276.23	275.97	275.88	26.78	-4.60	-0.96	41.95
21-Feb-2000 19:40:09	5.57	221.00	59.98	275.77	276.00	275.22	26.47	-4.67	-0.95	41.98
21-Feb-2000 19:30:09	5.21	218.00	59.98	276.00	276.09	275.91	20.66	-2.29	-0.94	42.01
21-Feb-2000 19:20:09	5.68	216.00	59.98	276.26	275.98	275.58	13.54	-6.75	-0.49	42.03
21-Feb-2000 19:10:09	5.97	216.00	60.13	277.25	277.22	277.74	15.34	-0.49	-0.57	42.04
21-Feb-2000 19:00:09	6.57	216.00	60.11	277.65	277.99	277.42	33.53	-3.76	-0.84	42.07
21-Feb-2000 18:50:09	7.19	216.00	60.09	278.60	278.37	277.97	51.83	-7.30	-0.95	42.16
21-Feb-2000 18:40:09	7.33	209.00	60.05	278.71	278.41	277.94	55.95	-8.36	-0.95	42.51
21-Feb-2000 18:30:09	7.73	205.00	60.02	278.47	278.56	278.05	68.09	-11.08	-0.97	42.81
21-Feb-2000 18:20:09	7.16	204.00	59.99	278.02	278.00	278.38	49.32	-7.11	-0.94	42.91
21-Feb-2000 18:10:09	6.98	203.00	59.98	278.12	278.20	278.19	46.89	-6.48	-0.92	42.93
21-Feb-2000 18:00:09	7.30	202.00	59.99	278.69	278.74	278.84	60.16	-9.01	-0.96	42.94
21-Feb-2000 17:50:09	6.94	211.00	59.97	278.68	278.89	277.93	47.49	-6.53	-0.87	42.95
21-Feb-2000 17:40:09	7.55	214.00	59.97	279.02	278.99	278.10	66.68	-10.55	-0.96	42.96
21-Feb-2000 17:30:09	7.61	215.00	59.97	278.85	279.00	278.93	71.78	-11.73	-0.97	42.96
21-Feb-2000 17:20:09	8.66	215.00	59.98	279.01	279.00	278.66	106.89	-21.43	-0.97	42.96
21-Feb-2000 17:10:09	7.86	215.00	59.97	278.92	279.00	278.75	79.96	-13.67	-0.97	42.98
21-Feb-2000 17:00:09	8.62	215.00	59.98	278.72	279.13	278.66	105.43	-20.95	-0.97	42.99
21-Feb-2000 16:50:09	9.78	216.00	59.98	279.11	279.33	278.92	139.67	-32.25	-0.97	42.98
21-Feb-2000 16:40:09	9.48	214.00	59.98	278.92	279.00	278.72	126.32	-27.92	-0.97	42.96
21-Feb-2000 16:30:09	8.73	216.00	59.98	279.10	278.94	278.87	106.51	-21.01	-0.98	42.96
21-Feb-2000 16:20:09	8.78	215.00	59.98	279.27	279.00	278.99	109.20	-21.81	-0.98	42.95
21-Feb-2000 16:10:09	8.56	214.00	59.97	279.02	278.94	278.39	96.75	-18.18	-0.98	42.95
21-Feb-2000 16:00:09	8.68	214.00	59.97	279.44	278.97	278.93	104.56	-20.32	-0.98	42.94
21-Feb-2000 15:50:09	8.46	216.00	59.97	279.64	278.96	278.70	104.91	-20.49	-0.98	42.94
21-Feb-2000 15:40:09	9.52	216.00	59.98	279.05	278.58	277.97	132.68	-29.68	-0.97	42.93
21-Feb-2000 15:30:09	9.95	212.00	59.98	279.48	278.76	278.23	139.33	-31.85	-0.97	42.80
21-Feb-2000 15:20:09	10.44	205.00	59.98	279.30	278.65	278.34	149.53	-35.72	-0.97	42.17
21-Feb-2000 15:10:09	10.41	205.00	59.97	279.18	278.98	278.26	148.79	-35.45	-0.97	42.04
21-Feb-2000 15:00:09	9.50	204.00	59.96	278.94	279.01	278.75	124.94	-26.73	-0.97	42.01
21-Feb-2000 14:50:09	8.85	202.00	59.96	279.13	278.75	278.50	107.76	-21.30	-0.97	41.99
21-Feb-2000 14:40:09	8.52	203.00	54.11	230.89	231.08	230.96	18.11	-6.17	0.71	42.02
21-Feb-2000 14:30:09	10.18	203.00	59.96	278.84	279.09	278.55	143.92	-33.56	-0.97	42.03
21-Feb-2000 14:20:09	10.21	203.00	59.96	278.92	279.10	278.59	146.65	-34.37	-0.97	42.02
21-Feb-2000 14:10:09	10.60	202.00	59.96	279.01	279.03	278.56	153.69	-37.21	-0.97	42.00
21-Feb-2000 14:00:09	9.96	202.00	59.96	279.04	279.04	278.40	138.74	-31.51	-0.97	41.98
21-Feb-2000 13:50:09	9.83	202.00	59.96	279.03	279.09	278.72	139.02	-31.41	-0.97	41.98
21-Feb-2000 13:40:09	9.49	200.00	59.96	279.28	279.15	278.68	132.12	-28.95	-0.97	42.00
21-Feb-2000 13:30:09	9.02	200.00	59.96	279.42	279.01	278.75	118.11	-24.15	-0.98	42.03
21-Feb-2000 13:20:09	10.11	207.00	59.96	278.92	279.04	278.49	143.46	-33.31	-0.97	42.15
21-Feb-2000 13:10:09	8.84	215.00	59.99	279.28	279.09	279.46	120.31	-24.55	-0.98	42.90
21-Feb-2000 13:00:09	9.71	211.00	59.99	279.26	279.03	278.79	148.87	-34.93	-0.97	42.98
21-Feb-2000 12:50:09	12.25	214.00	59.99	278.50	278.72	277.98	194.23	-54.79	-0.96	43.00
21-Feb-2000 12:40:09	12.05	226.00	60.00	278.62	278.83	277.93	180.18	-49.10	-0.97	43.01
21-Feb-2000 12:30:09	12.46	207.00	59.99	278.82	278.84	277.87	180.24	-49.50	-0.96	43.02
21-Feb-2000 12:20:09	11.53	176.00	59.99	278.56	279.02	277.64	159.01	-42.91	-0.96	43.03

WPMS Data Panel: 24h/10min Datalog

22-Feb-20

Current Park: SCI Wind Turbines
Current Turbine: Turbine 2 (2)

21-Feb-2000 12:10:09	11.44	175.00	59.99	279.00	278.96	277.95	165.12	-43.04	-0.97	43.05
21-Feb-2000 12:00:09	11.58	177.00	59.98	278.88	278.72	277.79	170.49	-44.44	-0.97	43.12
21-Feb-2000 11:50:09	12.57	175.00	59.99	279.70	279.01	278.17	196.40	-56.25	-0.96	43.30
21-Feb-2000 11:40:09	12.39	175.00	59.99	279.51	278.99	278.60	189.12	-53.30	-0.96	43.53
21-Feb-2000 11:30:09	12.68	175.00	59.99	279.40	279.01	278.48	196.60	-56.59	-0.96	43.90
21-Feb-2000 11:20:09	13.11	178.00	59.99	279.70	278.94	278.35	197.29	-56.90	-0.96	43.92
21-Feb-2000 11:10:09	14.21	178.00	60.00	279.25	278.24	278.16	211.60	-64.01	-0.96	43.90
21-Feb-2000 11:00:09	12.29	173.00	60.00	279.62	278.92	278.71	188.93	-52.97	-0.96	43.85
21-Feb-2000 10:50:09	11.68	171.00	59.99	279.37	278.97	278.39	178.18	-47.95	-0.97	43.87
21-Feb-2000 10:40:09	11.64	171.00	59.99	279.77	279.15	278.89	178.48	-48.24	-0.97	43.90
21-Feb-2000 10:30:09	11.48	173.00	59.99	279.24	279.26	278.27	179.17	-48.80	-0.97	43.92
21-Feb-2000 10:20:09	12.62	175.00	60.00	279.39	279.09	278.21	195.84	-56.46	-0.96	43.93
21-Feb-2000 10:10:09	13.18	175.00	60.00	279.48	279.06	278.07	202.98	-60.07	-0.96	43.84
21-Feb-2000 10:00:09	12.70	176.00	60.00	279.36	279.10	278.59	193.65	-55.50	-0.96	43.31
21-Feb-2000 09:50:09	12.35	175.00	60.00	279.30	279.20	278.31	193.75	-55.64	-0.96	43.08

WPMS Data Panel: 24h/10min Datalog

21-Apr-20

Current Park: SCI Wind Turbines
Current Turbine: Turbine 1 (1)

	Windspeed	Winddir.	Grid Freq.	Grid L1 V.	Grid L2 V.	Grid L3 V.	Grid kW	Grid kVAr	Grid CosPh	Int.Temp.
21-Apr-2000 06:21:06	8.09	238.00	59.98	279.60	279.63	279.02	86.35	-16.48	-0.97	40.02
21-Apr-2000 06:11:06	8.73	241.00	59.98	279.59	279.95	279.11	106.25	-21.75	-0.98	40.01
21-Apr-2000 06:01:06	8.38	239.00	59.98	279.68	280.02	279.37	96.84	-19.16	-0.98	40.00
21-Apr-2000 05:51:06	8.04	241.00	59.98	279.13	280.04	279.36	84.49	-15.77	-0.97	40.00
21-Apr-2000 05:41:06	8.34	238.00	59.98	279.83	280.07	279.41	93.72	-18.32	-0.98	39.99
21-Apr-2000 05:31:06	8.28	246.00	59.98	279.13	279.99	279.53	94.82	-18.88	-0.97	39.99
21-Apr-2000 05:21:06	8.29	245.00	59.98	278.98	280.14	279.20	95.29	-18.73	-0.98	39.99
21-Apr-2000 05:11:06	8.13	245.00	59.98	279.56	279.98	279.67	90.26	-17.48	-0.97	39.99
21-Apr-2000 05:01:06	7.78	241.00	59.98	279.25	280.05	279.77	77.54	-13.90	-0.97	39.99
21-Apr-2000 04:51:06	7.72	238.00	59.98	279.18	279.98	279.05	74.10	-13.16	-0.97	39.98
21-Apr-2000 04:41:06	6.56	239.00	59.98	279.23	279.91	278.71	33.54	-4.36	-0.86	39.97
21-Apr-2000 04:31:06	7.15	238.00	59.98	278.98	279.91	279.15	53.52	-8.29	-0.95	39.97
21-Apr-2000 04:21:06	6.77	239.00	59.98	279.16	279.90	279.01	41.77	-6.01	-0.88	39.97
21-Apr-2000 04:11:06	7.26	243.00	59.98	279.90	279.99	279.28	60.99	-9.95	-0.96	39.97
21-Apr-2000 04:01:06	7.22	244.00	59.98	279.37	280.06	279.15	58.89	-9.58	-0.94	39.96
21-Apr-2000 03:51:06	7.13	247.00	59.98	279.96	279.98	279.02	55.08	-8.53	-0.95	39.96
21-Apr-2000 03:41:06	6.48	248.00	59.98	278.12	279.12	278.09	41.43	-13.35	-0.89	39.96
21-Apr-2000 03:31:06	5.38	240.00	59.98	278.20	278.89	277.78	26.29	-4.25	-0.96	39.97
21-Apr-2000 03:21:06	5.38	238.00	59.98	278.26	278.90	277.48	26.57	-4.65	-0.93	39.97
21-Apr-2000 03:11:06	4.71	235.00	59.98	277.91	279.00	277.95	14.36	-0.09	-0.84	39.98
21-Apr-2000 03:01:06	4.25	237.00	59.98	277.89	278.97	277.77	7.31	1.84	-0.57	40.00
21-Apr-2000 02:51:06	4.90	237.00	59.98	277.82	279.00	277.34	11.27	-5.83	-0.58	40.01
21-Apr-2000 02:41:06	6.26	235.00	59.98	279.26	280.10	278.69	27.11	-2.99	-0.69	40.01
21-Apr-2000 02:31:06	7.48	232.00	59.98	279.92	280.78	279.28	64.91	-10.61	-0.97	40.01
21-Apr-2000 02:21:06	7.03	236.00	59.98	279.62	280.06	279.08	51.03	-7.57	-0.94	40.02
21-Apr-2000 02:11:06	7.37	229.00	59.98	279.76	280.21	279.46	58.93	-9.72	-0.93	40.02
21-Apr-2000 02:01:06	8.84	220.00	59.98	279.99	280.93	279.91	111.57	-23.37	-0.98	40.02
21-Apr-2000 01:51:06	8.57	227.00	59.98	279.98	280.84	279.84	103.32	-20.94	-0.98	40.01
21-Apr-2000 01:41:06	8.52	229.00	59.98	280.14	280.68	279.34	102.38	-20.57	-0.98	40.01
21-Apr-2000 01:31:06	7.74	224.00	59.98	279.98	280.70	279.29	74.69	-13.31	-0.97	40.00
21-Apr-2000 01:21:06	7.72	219.00	59.98	279.98	280.82	279.77	71.78	-12.42	-0.97	40.00
21-Apr-2000 01:11:06	8.34	223.00	59.98	280.00	280.85	279.75	92.99	-17.89	-0.98	39.99
21-Apr-2000 01:01:06	8.84	224.00	59.98	279.95	280.75	279.29	112.39	-23.65	-0.98	39.99
21-Apr-2000 00:51:06	8.35	220.00	59.98	279.86	280.88	279.32	92.42	-17.73	-0.97	39.98
21-Apr-2000 00:41:06	7.47	228.00	59.98	279.91	280.37	279.09	64.11	-10.38	-0.97	39.97
21-Apr-2000 00:31:06	6.39	226.00	59.98	278.25	279.13	277.93	37.38	-12.43	-0.87	39.98
21-Apr-2000 00:21:06	5.63	228.00	59.98	277.98	279.01	277.47	30.13	-5.66	-0.96	39.99
21-Apr-2000 00:11:06	4.87	231.00	59.98	277.97	279.20	277.90	17.31	-1.00	-0.87	40.00
21-Apr-2000 00:01:06	4.49	231.00	59.98	277.98	279.01	277.03	10.72	1.08	-0.79	40.02
20-Apr-2000 23:51:06	3.95	232.00	59.98	277.79	278.95	276.70	3.61	1.36	-0.03	40.05
20-Apr-2000 23:41:06	4.11	230.00	59.98	277.66	278.77	277.40	1.54	-2.89	-0.13	40.25
20-Apr-2000 23:31:06	6.03	232.00	59.98	278.46	279.77	278.00	19.65	-1.48	-0.62	40.79
20-Apr-2000 23:21:06	6.89	230.00	59.98	279.86	280.06	278.91	47.03	-6.64	-0.93	40.91
20-Apr-2000 23:11:06	6.31	233.00	59.98	279.11	279.73	278.28	27.44	-2.86	-0.81	40.93
20-Apr-2000 23:01:06	6.76	231.00	59.98	279.57	279.97	278.98	40.85	-5.27	-0.92	40.95
20-Apr-2000 22:51:06	6.74	233.00	59.98	279.80	279.97	279.00	40.02	-5.09	-0.92	40.96
20-Apr-2000 22:41:06	6.80	235.00	59.98	279.79	279.98	279.02	40.99	-5.25	-0.92	40.97
20-Apr-2000 22:31:06	6.47	239.00	59.98	279.15	279.85	278.68	31.19	-3.39	-0.84	40.99
20-Apr-2000 22:21:06	7.37	240.00	59.98	279.28	280.24	278.76	61.08	-9.41	-0.96	41.00
20-Apr-2000 22:11:06	7.93	239.00	59.98	279.88	280.44	279.09	81.31	-14.22	-0.98	41.00
20-Apr-2000 22:01:06	7.54	241.00	59.98	279.52	280.26	279.42	68.45	-11.06	-0.97	41.01
20-Apr-2000 21:51:06	8.00	240.00	59.98	279.59	280.12	279.56	84.90	-15.09	-0.98	41.02
20-Apr-2000 21:41:06	7.90	243.00	59.98	279.97	280.17	279.34	81.42	-14.20	-0.97	41.03
20-Apr-2000 21:31:06	7.08	244.00	59.98	279.60	279.92	279.08	52.82	-7.40	-0.95	41.05
20-Apr-2000 21:21:06	7.14	244.00	59.98	279.07	280.36	278.92	55.25	-7.84	-0.96	41.09
20-Apr-2000 21:11:06	6.63	244.00	59.98	278.69	279.89	278.62	38.02	-4.29	-0.90	41.41
20-Apr-2000 21:01:06	6.43	245.00	59.98	277.83	278.78	277.47	35.74	-11.14	-0.86	41.91
20-Apr-2000 20:51:06	5.72	245.00	59.98	277.39	279.06	277.94	17.63	-7.48	-0.51	41.97
20-Apr-2000 20:41:06	6.87	245.00	59.98	279.03	279.91	278.99	45.84	-5.58	-0.94	42.00
20-Apr-2000 20:31:06	6.43	245.00	59.98	278.41	279.48	278.71	31.29	-2.82	-0.83	42.02
20-Apr-2000 20:21:06	7.13	246.00	59.98	279.25	279.97	278.97	53.43	-7.05	-0.96	42.06
20-Apr-2000 20:11:06	7.65	246.00	59.98	279.07	279.97	279.31	71.51	-11.23	-0.96	42.61
20-Apr-2000 20:01:06	8.61	246.00	59.98	278.41	279.82	279.29	103.26	-19.46	-0.98	42.95
20-Apr-2000 19:51:06	9.37	246.00	59.98	278.97	279.84	279.22	129.20	-27.94	-0.97	42.98

WPMS Data Panel: 24h/10min Datalog

21-Apr-20

Current Park: SCI Wind Turbines
Current Turbine: Turbine 1 (1)

20-Apr-2000 19:41:06	9.72	245.00	59.98	278.94	279.72	278.95	140.72	-32.04	-0.97	43.00
20-Apr-2000 19:31:06	9.25	248.00	59.98	278.23	280.05	279.07	122.47	-25.59	-0.97	43.03
20-Apr-2000 19:21:06	8.95	246.00	59.98	278.01	279.96	279.11	116.74	-23.65	-0.98	43.17
20-Apr-2000 19:11:06	8.49	245.00	59.98	278.37	279.90	279.61	101.36	-18.93	-0.97	43.92
20-Apr-2000 19:01:06	8.97	243.00	59.98	278.67	279.98	279.61	110.54	-21.65	-0.98	43.99
20-Apr-2000 18:51:06	10.06	248.00	59.98	278.36	279.57	279.39	145.32	-33.90	-0.97	44.02
20-Apr-2000 18:41:06	10.13	248.00	59.98	278.62	278.99	279.27	149.16	-35.30	-0.97	44.07
20-Apr-2000 18:31:06	9.67	248.00	59.98	278.98	279.24	279.22	137.85	-31.05	-0.97	44.80
20-Apr-2000 18:21:06	9.96	248.00	59.99	278.95	279.67	278.81	144.80	-33.77	-0.97	44.97
20-Apr-2000 18:11:06	10.33	250.00	59.99	278.72	279.75	279.04	155.82	-38.07	-0.97	45.01
20-Apr-2000 18:01:06	10.48	251.00	59.99	279.00	279.42	278.95	159.98	-39.82	-0.97	45.05
20-Apr-2000 17:51:06	10.26	251.00	59.99	279.27	279.62	278.89	155.92	-38.23	-0.97	45.24
20-Apr-2000 17:41:06	10.74	251.00	59.99	279.31	279.28	279.09	166.26	-42.50	-0.97	45.87
20-Apr-2000 17:31:06	10.34	250.00	59.99	279.31	279.05	279.44	156.60	-38.56	-0.97	45.96
20-Apr-2000 17:21:06	10.05	251.00	59.98	278.98	278.89	278.81	150.87	-36.37	-0.97	45.97
20-Apr-2000 17:11:06	9.99	251.00	59.99	278.99	279.26	278.94	150.18	-36.11	-0.97	46.01
20-Apr-2000 17:01:06	10.31	250.00	59.98	278.59	278.88	278.59	155.34	-38.18	-0.97	46.02
20-Apr-2000 16:51:06	9.94	249.00	59.99	279.04	279.01	278.46	146.23	-34.70	-0.97	46.02
20-Apr-2000 16:41:06	9.62	249.00	59.98	279.42	279.17	278.63	134.78	-30.48	-0.97	46.04
20-Apr-2000 16:31:06	9.15	250.00	59.98	279.92	280.14	279.44	124.18	-26.92	-0.97	46.05
20-Apr-2000 16:21:06	9.69	248.00	59.98	280.11	280.64	280.03	138.95	-32.11	-0.97	46.06
20-Apr-2000 16:11:06	9.92	248.00	59.99	280.64	280.65	280.03	144.91	-34.43	-0.97	46.06
20-Apr-2000 16:01:06	9.88	246.00	59.99	280.73	280.81	280.03	140.11	-32.70	-0.97	46.06
20-Apr-2000 15:51:06	10.15	245.00	59.99	280.48	280.33	280.00	148.03	-35.73	-0.97	46.04
20-Apr-2000 15:41:06	10.04	243.00	59.99	280.48	280.30	279.93	148.17	-35.88	-0.97	46.04
20-Apr-2000 15:31:06	10.22	240.00	59.99	280.40	280.42	280.07	151.78	-37.35	-0.97	46.03
20-Apr-2000 15:21:06	10.37	236.00	59.99	280.30	280.21	280.02	155.48	-38.87	-0.97	46.02
20-Apr-2000 15:11:06	10.31	235.00	59.99	279.41	279.71	279.33	154.40	-38.60	-0.97	46.00
20-Apr-2000 15:01:06	10.16	234.00	59.99	279.20	279.27	278.88	154.37	-38.83	-0.97	45.98
20-Apr-2000 14:51:06	10.51	236.00	59.99	279.07	279.02	278.92	156.13	-39.58	-0.97	45.95
20-Apr-2000 14:41:06	9.97	233.00	59.99	279.00	279.25	279.00	149.23	-36.92	-0.97	45.78
20-Apr-2000 14:31:06	9.41	232.00	59.99	279.10	279.15	278.99	131.31	-30.38	-0.97	45.11
20-Apr-2000 14:21:06	9.01	232.00	59.99	279.03	279.34	279.00	117.38	-25.70	-0.97	45.03
20-Apr-2000 14:11:06	8.96	232.00	59.99	278.99	279.16	278.93	116.48	-25.49	-0.97	45.01
20-Apr-2000 14:01:06	8.57	232.00	59.98	278.95	278.99	278.47	104.41	-21.78	-0.97	44.98
20-Apr-2000 13:51:06	8.40	232.00	59.98	278.97	279.02	278.86	96.57	-19.61	-0.97	44.96
20-Apr-2000 13:41:06	7.85	234.00	59.98	278.48	279.00	278.19	75.96	-14.03	-0.97	44.92
20-Apr-2000 13:31:06	7.30	237.00	59.98	278.53	278.99	278.16	58.64	-10.04	-0.95	44.59
20-Apr-2000 13:21:06	6.97	240.00	59.98	278.37	278.85	278.01	45.90	-7.32	-0.93	44.12
20-Apr-2000 13:11:06	7.03	243.00	59.98	278.20	278.99	277.97	49.34	-8.01	-0.94	44.06
20-Apr-2000 13:01:06	7.20	244.00	59.98	278.22	278.94	278.04	56.20	-9.58	-0.95	44.04
20-Apr-2000 12:51:06	7.32	244.00	59.98	278.44	278.99	278.23	59.86	-10.46	-0.96	44.03
20-Apr-2000 12:41:06	7.08	243.00	59.98	278.63	278.97	278.03	50.69	-8.48	-0.94	44.02
20-Apr-2000 12:31:06	6.68	247.00	59.98	277.98	278.28	277.78	35.95	-5.55	-0.86	44.00
20-Apr-2000 12:21:06	6.31	245.00	59.98	277.61	278.15	277.51	27.45	-3.92	-0.77	43.98
20-Apr-2000 12:11:06	6.28	244.00	59.98	277.13	277.61	276.81	28.66	-11.51	-0.73	43.95
20-Apr-2000 12:01:06	5.74	244.00	59.98	277.05	277.92	276.90	31.51	-6.97	-0.96	43.92
20-Apr-2000 11:51:06	5.40	244.00	59.98	276.99	277.83	276.87	25.60	-4.56	-0.95	43.46
20-Apr-2000 11:41:06	4.85	245.00	59.98	277.29	277.81	277.15	15.54	-0.95	-0.86	43.06
20-Apr-2000 11:31:06	5.28	244.00	59.98	277.03	277.20	276.97	23.29	-3.65	-0.93	43.02
20-Apr-2000 11:21:06	4.67	245.00	59.98	277.55	277.65	276.94	12.68	-0.11	-0.79	43.00
20-Apr-2000 11:11:06	4.70	248.00	59.98	277.38	277.59	276.98	12.20	0.05	-0.77	42.96
20-Apr-2000 11:01:06	4.02	252.00	59.98	276.92	277.38	277.17	2.26	1.84	-0.15	42.91
20-Apr-2000 10:51:06	4.91	259.00	59.98	276.98	277.88	276.99	15.18	-0.87	-0.82	42.30
20-Apr-2000 10:41:06	3.73	268.00	59.98	277.00	277.88	276.82	0.69	0.33	0.59	42.08
20-Apr-2000 10:31:06	3.70	268.00	59.98	276.92	277.65	276.71	-0.50	0.44	0.55	42.04
20-Apr-2000 10:21:06	4.16	268.00	59.98	276.98	277.90	276.97	4.47	1.87	-0.33	42.03
20-Apr-2000 10:11:06	4.60	269.00	59.98	276.98	277.98	277.00	11.60	0.16	-0.74	41.99
20-Apr-2000 10:01:06	4.48	269.00	59.99	276.79	277.95	277.00	10.58	0.44	-0.68	41.96
20-Apr-2000 09:51:06	4.30	268.00	59.99	276.94	277.92	277.11	6.62	1.52	-0.50	41.80
20-Apr-2000 09:41:06	4.48	269.00	59.99	277.05	277.86	276.97	10.22	0.57	-0.69	41.08
20-Apr-2000 09:31:06	4.55	269.00	59.99	277.22	277.83	277.00	10.96	0.42	-0.72	41.01
20-Apr-2000 09:21:06	4.42	269.00	59.99	276.08	276.35	276.00	9.21	0.83	-0.59	40.97
20-Apr-2000 09:11:06	3.85	267.00	59.99	275.08	275.02	275.14	1.42	0.65	0.16	40.90
20-Apr-2000 09:01:06	2.69	262.00	59.99	274.22	275.34	274.60	0.00	0.00	1.00	40.49

WPMS Data Panel: 24h/10min Datalog

21-Apr-20

Current Park: SCI Wind Turbines
Current Turbine: Turbine 1 (1)

20-Apr-2000 08:51:06	2.67	265.00	59.99	274.25	275.61	274.77	-0.65	-0.14	0.90	40.10
20-Apr-2000 08:41:06	3.38	265.00	59.99	274.65	275.60	274.99	-0.43	0.95	0.73	40.05
20-Apr-2000 08:31:06	4.04	265.00	59.99	275.12	276.00	274.89	2.24	1.92	-0.16	40.01
20-Apr-2000 08:21:06	3.92	265.00	59.99	275.87	276.66	275.94	1.06	2.83	-0.11	39.98
20-Apr-2000 08:11:06	4.23	265.00	59.98	276.08	277.01	276.63	5.58	1.91	-0.47	39.85
20-Apr-2000 08:01:06	4.46	263.00	59.98	276.68	277.02	276.67	9.89	0.89	-0.74	39.08
20-Apr-2000 07:51:06	4.22	264.00	59.98	277.33	278.03	277.73	5.46	2.04	-0.56	39.01
20-Apr-2000 07:41:06	3.63	265.00	59.98	276.71	277.22	276.73	0.94	1.03	0.38	38.98
20-Apr-2000 07:31:06	3.49	265.00	59.98	278.11	278.59	277.94	-0.04	0.10	0.98	38.97
20-Apr-2000 07:21:06	3.17	264.00	59.98	277.18	277.39	276.90	-0.42	-0.22	0.89	38.96
20-Apr-2000 07:11:06	2.71	264.00	59.98	276.43	276.86	276.10	0.00	0.00	1.00	38.95
20-Apr-2000 07:01:06	4.14	265.00	59.98	276.96	276.98	276.43	3.51	2.28	-0.28	38.93
20-Apr-2000 06:51:06	4.71	265.00	59.98	276.98	277.06	276.27	12.18	0.40	-0.85	38.65
20-Apr-2000 06:41:06	4.84	259.00	59.98	277.06	276.65	275.99	15.51	-0.58	-0.91	38.14
20-Apr-2000 06:31:06	4.68	257.00	59.98	276.53	276.11	276.30	12.40	0.30	-0.85	38.08

WPMS Data Panel: 24h/10min Datalog

21-Apr-20

Current Park: SCI Wind Turbines
Current Turbine: Turbine 2 (2)

	Windspeed	Winddir.	Grid Freq.	Grid L1 V.	Grid L2 V.	Grid L3 V.	Grid kW	Grid kVAr	Grid CosPh	Int.Temp.
21-Apr-2000 06:20:09	8.32	229.00	59.98	279.84	280.04	279.52	93.00	-18.83	-0.97	42.95
21-Apr-2000 06:10:09	8.56	229.00	59.98	279.90	280.54	279.72	100.05	-20.77	-0.97	42.94
21-Apr-2000 06:00:09	8.38	228.00	59.98	279.85	280.85	279.85	95.18	-19.39	-0.97	42.92
21-Apr-2000 05:50:09	8.14	229.00	59.98	279.68	280.68	279.83	86.25	-16.94	-0.97	42.93
21-Apr-2000 05:40:09	8.27	227.00	59.98	279.92	280.86	279.88	91.55	-18.54	-0.97	42.91
21-Apr-2000 05:30:09	8.39	231.00	59.98	279.27	280.61	279.78	91.20	-18.55	-0.97	42.91
21-Apr-2000 05:20:09	8.29	231.00	59.98	279.10	280.67	279.62	88.97	-17.77	-0.97	42.87
21-Apr-2000 05:10:09	8.17	229.00	59.98	279.94	280.56	279.94	86.42	-16.98	-0.97	42.60
21-Apr-2000 05:00:09	7.56	228.00	59.98	279.20	280.23	279.86	69.52	-12.76	-0.96	42.29
21-Apr-2000 04:50:09	7.03	229.00	59.98	279.36	280.05	278.99	49.92	-8.42	-0.92	42.13
21-Apr-2000 04:40:09	6.64	229.00	59.98	279.34	279.91	278.78	35.44	-5.50	-0.82	42.11
21-Apr-2000 04:30:09	7.01	227.00	59.98	278.97	280.05	279.46	49.43	-8.23	-0.93	42.09
21-Apr-2000 04:20:09	6.97	228.00	59.98	279.53	279.99	279.03	47.03	-7.74	-0.90	42.07
21-Apr-2000 04:10:09	7.17	231.00	59.98	279.76	280.45	279.64	52.61	-8.91	-0.93	42.06
21-Apr-2000 04:00:09	7.49	229.00	59.98	279.77	280.07	279.41	63.16	-11.15	-0.95	42.04
21-Apr-2000 03:50:09	7.30	232.00	59.98	279.76	280.04	278.99	52.97	-10.73	-0.92	42.03
21-Apr-2000 03:40:09	5.96	231.00	59.98	277.81	278.85	277.79	32.93	-11.17	-0.92	42.03
21-Apr-2000 03:30:09	5.32	229.00	59.98	278.17	278.90	277.62	24.72	-3.97	-0.93	42.03
21-Apr-2000 03:20:09	5.29	229.00	59.98	278.20	278.97	277.68	23.38	-3.76	-0.90	42.03
21-Apr-2000 03:10:09	4.55	228.00	59.98	277.90	278.98	277.90	10.41	0.82	-0.72	42.05
21-Apr-2000 03:00:09	4.29	229.00	59.98	277.90	278.98	277.71	7.27	1.64	-0.58	42.13
21-Apr-2000 02:50:09	5.32	220.00	59.98	278.04	279.16	277.39	11.77	-6.18	-0.52	42.53
21-Apr-2000 02:40:09	6.74	217.00	59.98	279.56	280.46	279.02	37.05	-5.69	-0.80	42.64
21-Apr-2000 02:30:09	7.33	216.00	59.98	279.94	280.76	279.63	56.61	-9.59	-0.94	42.57
21-Apr-2000 02:20:09	6.77	218.00	59.98	279.57	280.20	279.12	37.49	-5.74	-0.86	42.69
21-Apr-2000 02:10:09	7.82	214.00	59.98	280.05	280.82	279.83	74.89	-14.45	-0.94	42.78
21-Apr-2000 02:00:09	8.62	213.00	59.98	280.03	281.05	280.01	104.06	-21.87	-0.97	42.48
21-Apr-2000 01:50:09	8.53	216.00	59.98	280.33	281.04	279.96	98.29	-20.21	-0.97	42.14
21-Apr-2000 01:40:09	8.38	216.00	59.98	280.26	280.98	279.86	93.31	-18.74	-0.97	42.07
21-Apr-2000 01:30:09	7.41	215.00	59.98	279.99	280.97	279.80	61.72	-10.85	-0.95	42.06
21-Apr-2000 01:20:09	7.73	212.00	59.98	280.01	280.98	279.97	74.96	-13.98	-0.96	42.06
21-Apr-2000 01:10:09	8.29	214.00	59.98	280.29	281.00	279.95	92.79	-18.57	-0.97	42.04
21-Apr-2000 01:00:09	8.70	214.00	59.98	280.00	281.00	279.92	105.96	-22.35	-0.97	42.03
21-Apr-2000 00:50:09	7.72	215.00	59.98	279.97	280.98	279.66	73.90	-13.59	-0.96	42.02
21-Apr-2000 00:40:09	7.12	222.00	59.98	279.63	280.53	279.02	50.83	-14.82	-0.89	42.02
21-Apr-2000 00:30:09	5.95	224.00	59.98	277.96	278.99	277.80	29.99	-5.88	-0.96	42.03
21-Apr-2000 00:20:09	5.50	224.00	59.98	277.98	278.99	277.41	24.55	-3.66	-0.95	42.06
21-Apr-2000 00:10:09	4.69	226.00	59.98	277.97	279.12	277.87	10.88	0.76	-0.73	42.21
21-Apr-2000 00:00:09	4.64	225.00	59.98	277.99	278.97	276.52	9.42	1.20	-0.72	42.85
20-Apr-2000 23:50:09	3.85	227.00	59.98	277.64	278.86	276.93	0.63	1.38	0.34	42.96
20-Apr-2000 23:40:09	4.73	224.00	59.98	277.70	278.82	277.39	2.95	-3.74	-0.17	43.00
20-Apr-2000 23:30:09	6.22	225.00	59.98	278.92	279.97	278.31	22.52	-2.82	-0.66	43.01
20-Apr-2000 23:20:09	6.58	224.00	59.98	279.58	280.10	278.66	33.92	-4.93	-0.82	43.01
20-Apr-2000 23:10:09	6.23	226.00	59.98	279.24	279.79	278.62	23.66	-2.96	-0.73	43.03
20-Apr-2000 23:00:09	6.55	226.00	59.98	279.67	280.04	279.07	33.77	-4.70	-0.86	43.04
20-Apr-2000 22:50:09	6.63	227.00	59.98	279.91	280.02	279.01	36.20	-5.12	-0.88	43.06
20-Apr-2000 22:40:09	6.62	229.00	59.98	279.66	280.02	279.13	34.96	-4.83	-0.87	43.14
20-Apr-2000 22:30:09	6.45	230.00	59.98	279.13	279.87	278.58	26.81	-3.36	-0.74	43.62
20-Apr-2000 22:20:09	7.53	234.00	59.98	279.63	280.79	279.17	57.94	-9.46	-0.95	43.92
20-Apr-2000 22:10:09	7.83	235.00	59.98	279.90	280.94	279.69	66.54	-11.32	-0.96	43.94
20-Apr-2000 22:00:09	7.67	234.00	59.98	279.74	280.87	279.86	61.81	-10.28	-0.95	43.96
20-Apr-2000 21:50:09	7.89	235.00	59.98	279.72	280.87	279.68	70.74	-12.23	-0.96	43.96
20-Apr-2000 21:40:09	7.47	235.00	59.98	279.96	280.79	279.82	62.88	-10.49	-0.95	43.98
20-Apr-2000 21:30:09	6.72	236.00	59.98	279.39	280.19	278.89	40.83	-5.69	-0.90	43.99
20-Apr-2000 21:20:09	6.87	235.00	59.98	279.04	280.53	278.91	45.93	-6.63	-0.92	44.01
20-Apr-2000 21:10:09	6.38	235.00	59.98	278.72	279.78	278.55	28.59	-4.26	-0.80	44.02
20-Apr-2000 21:00:09	5.90	239.00	59.98	277.24	278.50	277.01	33.17	-13.19	-0.90	44.07
20-Apr-2000 20:50:09	5.83	239.00	59.98	278.12	279.30	278.51	15.51	-5.55	-0.42	44.61
20-Apr-2000 20:40:09	6.63	236.00	59.98	278.92	279.93	279.09	38.96	-5.02	-0.90	44.94
20-Apr-2000 20:30:09	6.24	240.00	59.98	278.59	279.53	278.75	24.09	-2.34	-0.70	44.96
20-Apr-2000 20:20:09	6.90	240.00	59.98	279.30	280.02	279.02	45.32	-6.14	-0.92	45.00
20-Apr-2000 20:10:09	7.78	240.00	59.98	279.17	280.08	279.66	76.59	-13.08	-0.96	45.03
20-Apr-2000 20:00:09	8.25	238.00	59.98	278.62	280.03	279.70	93.13	-17.32	-0.97	45.20
20-Apr-2000 19:50:09	9.16	238.00	59.98	279.44	280.24	279.39	121.75	-26.09	-0.97	45.88

WPMS Data Panel: 24h/10min Datalog

21-Apr-20

Current Park: SCI Wind Turbines
Current Turbine: Turbine 2 (2)

20-Apr-2000 19:40:09	9.27	237.00	59.98	279.09	280.70	279.51	125.44	-27.26	-0.97	45.95
20-Apr-2000 19:30:09	8.75	241.00	59.98	278.44	280.69	279.45	109.58	-22.06	-0.97	45.99
20-Apr-2000 19:20:09	8.43	237.00	59.98	278.28	280.61	279.66	98.63	-18.83	-0.97	46.04
20-Apr-2000 19:10:09	8.22	238.00	59.98	278.76	280.32	279.89	88.52	-15.94	-0.97	46.67
20-Apr-2000 19:00:09	8.79	236.00	59.98	278.95	280.56	280.01	103.85	-20.53	-0.97	46.97
20-Apr-2000 18:50:09	9.75	238.00	59.98	278.80	280.06	279.66	138.65	-31.94	-0.97	47.02
20-Apr-2000 18:40:09	9.62	239.00	59.98	279.21	279.84	279.76	136.56	-31.22	-0.97	47.10
20-Apr-2000 18:30:09	9.24	238.00	59.98	279.17	280.27	279.72	126.28	-27.66	-0.97	47.81
20-Apr-2000 18:20:09	9.75	238.00	59.99	279.06	280.19	279.16	139.09	-32.30	-0.97	47.97
20-Apr-2000 18:10:09	9.94	239.00	59.99	279.00	280.65	279.64	145.86	-34.84	-0.97	48.00
20-Apr-2000 18:00:09	10.04	240.00	59.99	279.40	280.12	279.16	148.12	-35.73	-0.97	48.04
20-Apr-2000 17:50:09	10.13	241.00	59.99	279.80	280.35	279.50	150.28	-36.60	-0.97	48.07
20-Apr-2000 17:40:09	10.27	241.00	59.99	279.65	280.03	279.67	154.40	-38.32	-0.97	48.24
20-Apr-2000 17:30:09	9.84	240.00	59.98	279.43	279.62	279.49	142.39	-33.70	-0.97	48.76
20-Apr-2000 17:20:09	9.97	241.00	59.98	279.20	279.88	279.13	144.77	-34.62	-0.97	48.92
20-Apr-2000 17:10:09	9.76	240.00	59.98	279.27	279.86	279.28	140.88	-33.21	-0.97	48.94
20-Apr-2000 17:00:09	9.97	240.00	59.98	278.94	279.70	278.94	144.40	-34.53	-0.97	48.94
20-Apr-2000 16:50:09	9.66	240.00	59.98	279.63	279.97	278.97	134.42	-31.01	-0.97	48.93
20-Apr-2000 16:40:09	9.12	240.00	59.98	279.69	279.98	279.14	120.34	-26.16	-0.97	48.92
20-Apr-2000 16:30:09	9.08	240.00	59.98	280.54	280.98	280.09	118.26	-25.63	-0.97	48.91
20-Apr-2000 16:20:09	9.58	239.00	59.98	280.61	281.39	280.69	133.75	-30.92	-0.97	48.73
20-Apr-2000 16:10:09	9.71	238.00	59.98	280.91	281.18	280.30	137.04	-32.17	-0.97	48.24
20-Apr-2000 16:00:09	9.66	239.00	59.99	280.97	281.70	280.78	131.84	-30.43	-0.97	48.08
20-Apr-2000 15:50:09	9.87	240.00	59.99	280.90	281.01	280.18	141.41	-33.90	-0.97	48.04
20-Apr-2000 15:40:09	10.03	233.00	59.99	280.66	281.30	280.20	139.48	-33.31	-0.97	48.02
20-Apr-2000 15:30:09	9.83	229.00	59.99	280.87	281.04	280.63	139.68	-33.44	-0.97	48.00
20-Apr-2000 15:20:09	9.92	229.00	59.99	280.21	280.98	280.34	144.68	-35.37	-0.97	47.98
20-Apr-2000 15:10:09	9.89	229.00	59.99	279.72	280.31	279.31	142.87	-34.85	-0.97	47.96
20-Apr-2000 15:00:09	10.05	228.00	59.99	279.48	279.97	279.00	146.53	-36.42	-0.97	47.94
20-Apr-2000 14:50:09	10.17	228.00	59.99	279.66	280.00	279.10	147.93	-36.99	-0.97	47.57
20-Apr-2000 14:40:09	9.53	228.00	59.99	279.17	280.00	279.50	132.99	-31.62	-0.97	47.07
20-Apr-2000 14:30:09	8.86	227.00	59.99	279.39	279.99	279.31	112.84	-24.91	-0.97	47.04
20-Apr-2000 14:20:09	8.68	227.00	59.99	279.02	279.99	279.08	106.63	-23.04	-0.97	47.02
20-Apr-2000 14:10:09	8.71	228.00	59.98	279.07	279.97	279.00	106.82	-23.21	-0.97	47.00
20-Apr-2000 14:00:09	8.44	228.00	59.98	279.00	279.54	278.83	97.11	-20.43	-0.97	46.97
20-Apr-2000 13:50:09	7.90	227.00	59.98	278.97	279.63	278.90	80.37	-15.98	-0.96	46.95
20-Apr-2000 13:40:09	7.34	229.00	59.98	278.47	279.17	278.24	60.43	-11.21	-0.95	46.92
20-Apr-2000 13:30:09	6.91	230.00	59.98	278.62	278.97	278.31	46.05	-8.18	-0.90	46.76
20-Apr-2000 13:20:09	6.77	230.00	59.98	278.61	278.93	278.13	41.17	-7.26	-0.88	46.37
20-Apr-2000 13:10:09	6.78	238.00	59.98	277.98	279.00	277.99	38.50	-6.72	-0.88	46.14
20-Apr-2000 13:00:09	7.11	241.00	59.98	278.35	279.12	278.34	49.69	-9.06	-0.92	46.09
20-Apr-2000 12:50:09	7.27	240.00	59.98	278.59	279.09	278.28	51.03	-9.33	-0.93	46.06
20-Apr-2000 12:40:09	6.93	240.00	59.98	278.70	278.93	278.07	41.59	-7.44	-0.89	46.04
20-Apr-2000 12:30:09	6.29	233.00	59.98	277.74	278.08	277.70	21.20	-3.63	-0.61	46.03
20-Apr-2000 12:20:09	6.21	236.00	59.98	277.66	278.23	277.54	26.52	-11.61	-0.74	46.01
20-Apr-2000 12:10:09	5.95	238.00	59.98	276.88	277.46	276.55	31.61	-7.34	-0.95	46.00
20-Apr-2000 12:00:09	5.63	239.00	59.98	277.07	277.95	276.89	28.24	-5.81	-0.95	45.97
20-Apr-2000 11:50:09	5.18	235.00	59.98	276.98	277.80	276.97	20.12	-2.76	-0.91	45.97
20-Apr-2000 11:40:09	4.68	239.00	59.98	277.23	277.41	277.11	11.57	-0.16	-0.71	45.96
20-Apr-2000 11:30:09	5.13	239.00	59.98	277.05	277.25	276.95	19.14	-2.51	-0.88	45.91
20-Apr-2000 11:20:09	4.69	240.00	59.98	277.57	277.46	276.94	11.99	-0.18	-0.76	45.38
20-Apr-2000 11:10:09	4.48	244.00	59.98	277.22	277.41	276.87	8.98	-0.33	-0.42	45.06
20-Apr-2000 11:00:09	3.99	252.00	59.98	276.90	277.20	277.12	1.41	2.35	-0.12	45.03
20-Apr-2000 10:50:09	4.61	252.00	59.98	276.96	277.97	276.94	11.49	-0.83	-0.59	45.00
20-Apr-2000 10:40:09	3.66	260.00	59.98	276.92	277.49	276.49	-0.26	0.54	0.59	44.98
20-Apr-2000 10:30:09	3.61	261.00	59.98	276.91	277.36	276.69	-0.74	0.29	0.78	44.96
20-Apr-2000 10:20:09	4.18	260.00	59.98	276.98	277.78	276.98	4.06	1.72	-0.30	44.95
20-Apr-2000 10:10:09	4.55	256.00	59.98	276.98	277.97	277.00	9.01	0.62	-0.63	44.51
20-Apr-2000 10:00:09	4.37	264.00	59.99	276.64	277.79	277.01	6.83	1.09	-0.46	44.05
20-Apr-2000 09:50:09	4.34	264.00	59.99	276.98	277.81	277.01	6.55	1.27	-0.50	44.01
20-Apr-2000 09:40:09	4.45	265.00	59.99	277.03	277.67	276.97	8.48	0.81	-0.61	43.98
20-Apr-2000 09:30:09	4.65	264.00	59.99	277.17	277.50	276.99	12.03	-0.10	-0.76	43.78
20-Apr-2000 09:20:09	4.30	265.00	59.99	275.45	275.68	275.39	6.58	0.68	-0.43	43.07
20-Apr-2000 09:10:09	3.53	276.00	59.99	274.89	274.96	274.80	0.06	0.33	0.62	43.03
20-Apr-2000 09:00:09	2.90	278.00	59.99	274.04	275.12	274.67	0.00	0.00	1.00	43.02

WPMS Data Panel: 24h/10min Datalog

21-Apr-20

Current Park: SCI Wind Turbines
Current Turbine: Turbine 2 (2)

20-Apr-2000 08:50:09	3.21	277.00	59.99	274.12	275.11	274.55	0.00	0.00	1.00	43.02
20-Apr-2000 08:40:09	3.83	262.00	59.99	274.81	275.81	274.90	0.43	2.09	0.16	43.00
20-Apr-2000 08:30:09	4.03	262.00	59.99	275.60	276.31	275.27	1.62	1.87	-0.13	42.95
20-Apr-2000 08:20:09	3.99	262.00	59.99	275.59	276.50	275.89	1.04	2.62	-0.10	42.39
20-Apr-2000 08:10:09	4.46	255.00	59.98	276.04	276.99	276.37	7.45	1.22	-0.58	42.02
20-Apr-2000 08:00:09	4.43	266.00	59.98	276.64	277.00	276.77	6.38	1.54	-0.52	41.97
20-Apr-2000 07:50:09	4.09	267.00	59.98	277.59	278.01	277.67	2.34	2.48	-0.26	41.79
20-Apr-2000 07:40:09	3.41	269.00	59.98	276.87	277.41	276.92	0.27	-0.02	0.79	41.26
20-Apr-2000 07:30:09	3.54	269.00	59.98	277.94	278.11	277.72	0.00	0.00	1.00	41.17
20-Apr-2000 07:20:09	3.37	271.00	59.98	276.83	276.79	276.33	-0.57	-0.19	0.89	41.12
20-Apr-2000 07:10:09	3.17	260.00	59.98	276.32	276.69	276.09	-0.27	0.29	0.93	41.11
20-Apr-2000 07:00:09	4.27	257.00	59.98	276.96	276.96	276.29	4.25	2.14	-0.41	41.05
20-Apr-2000 06:50:09	4.64	257.00	59.98	276.98	277.01	276.05	10.12	0.76	-0.78	41.03
20-Apr-2000 06:40:09	4.72	257.00	59.98	276.97	276.39	275.97	12.87	0.01	-0.86	41.01
20-Apr-2000 06:30:09	4.38	257.00	59.98	276.51	275.97	276.46	6.82	1.60	-0.64	41.01

Appendix E. Economic Summary Table

This appendix contains the economic summary table used to develop the economic conclusions reached in this report.

Appendix E. Economic Summary Table

This appendix contains the economic summary table used to develop the economic conclusions reached in this report.

ECONOMIC ANALYSIS	**Site:**	**San Clemente Island, CA, 6.0 m/s avg, 12 months ending Sep 30, 2000**						
	Turbine:	**225 kW, Commercial**						
	Quantity:	**3**						
Input Values				**Economic Factors**				
						a variable	n variable	Y(a,n)
System load (kWh/y)	SL	7,795,014		Present worth factor of fuel				
Diesel energy (kWh/y)		6,682,926		costs, PWFF, a=(1+e)/(1+d)		0.95416277	20	12.67203
Wind energy (kWh/y)		1,112,088		Present worth factor of O&M				
Diesel fuel usage, no wind (l/yr)	FL	2,335,748		costs, PWFO, a=(1+i)/(1+d)		0.95416277	20	12.67203
Diesel fuel usage, with wind (l/yr)	FL	2,002,560		Present worth factor of interest				
Diesel fuel cost ($/l)	FC	0.386		payments, PWFP, a=1/(1+b)		0.9354537	10	7.05616
Diesel ops cost, variable ($/kWh)	OV	0.202						
Diesel ops cost, fixed ($/y)	OF	481,171						
Wind ICC ($)	WC	722,007						
Wind O&M cost ($/kWh)	WO	0.01						
System life, (yrs)	L	20						
General inflation	i	2.0%				a variable	n variable	X(a,n)
Fuel inflation	e	2.0%		Capital recovery factor for system				
Discount rate	d	6.9%		income, CRFI, a=1/(1+d)		0.9354537	20	0.09366054
Interest	b	10.0%		Capital recovery factor for interest				
Term of loan, (yrs)	N	10		payments, CRFP, a=1/(1+b)		0.90909091	10	0.16274539
Calculated Values for Both Systems			Diesel		Hybrid System		Hybrid System	Hybrid System
			Only		Diesel Part		Wind Part	Total
Capital cost	C = ICC+BOS		0		0		2,166,021	2,166,021
Initial payment on system	Ad		0		0		2,166,021	2,166,021
Loan	Al = C - Ad		0		0		0	0
Annual payment	Ap = Al * CRFP		0		0		0	0
NPV of annual payment	Apnpv = Ap*PWFP		0		0		0	0
Fuel cost per annum	Af = FL * FC		901,599		772,988		0	772,988
NPV of fuel costs	Afnpv = Af * PWFF		11,425,089		9,795,331		0	9,795,331
Overhaul cost per annum	Ao		0		0		3,000	3,000
NPV of overhaul costs	Aonpv = Ao * PWFO		0		0		38,016	38,016
O&M costs per annum	Am		2,055,764		1,831,122		11,121	1,842,243
NPV of O&M costs	Amnpv = Am*PWFO		26,050,707		23,204,039		140,924	23,344,963
Total annual costs	At = Ap+Af+Ao+Am		2,957,363		2,604,110		14,121	2,618,231
Total system NPV, TNPV	= Ad+sum(NPVs)		37,475,796		32,999,370		2,344,961	35,344,332
Annual savings	Sv = dsl At - hbd At							339,131
Levelized cost of energy, COE	= TNPV*CRFI/SL		0.450		0.462		0.197	0.425
Simple payback period, years								6.39
Internal rate of return, IRR, (x)	[(1+x)^L-1]/[x*(1+x)^L] - P =			0.000				14.6%
(NPV = net present value; ICC = initial capitol cost; BOS = balance of station = 26% ICC; O&M = operations and maintenance)								

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13. ABSTRACT *(Maximum 200 words)*
The purpose of this report is to evaluate the wind power benefits and impacts to the San Clement Island wind power system, including energy savings, emissions reduction, system stability, and decreased naval dependence on fossil fuel at the island. The primary goal of the SCI wind power system has been to operate with the existing diesel power plant and provide equivalent or better power quality and system reliability than the existing diesel system. The wind system is intended to reduce, as far as possible, the use of diesel fuel and the inerent generation of nitrogen oxide emissions and other pollutants.

14. SUBJECT TERMS
Wind energy; hybrid; diesel; Department of Defense; San Clemente Island

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