



August 29, 2016

Subject: Block Island Power Company - Engineering Review

Introduction

SGC Engineering LLC (SGC) was hired by the Town of New Shoreham, through Tilson Technologies, to perform a one day (August 4, 2016), high level review of the Block Island Power Company (BIPCO). New Shoreham is considering the acquisition of 2/3 of the shares of BIPCO, and requested this report in anticipation of a town meeting in September.

BIPCO is a private utility, operating on Block Island. BIPCO generates and distributes electrical power for the whole island. Generation is done with the use of five diesel operated generators, and power is distributed via six circuits for the island. A power substation collects from the generators, adjusts voltage and routes power to the six circuits. All operations and maintenance are performed by BIPCO employees and supplemental outside contractors. BIPCO owns and leases space on a tower to cell phone and radio station users. BIPCO tankage is used by a local heating oil company who delivers to island residents.

BIPCO had a fire in the generator building, early in the morning of July 23, 2016. Significant damage occurred to the generation capability, the generator building, and to the three service vehicles. BIPCO acquired and set up temporary generators, to supply electricity to residents.

National Grid is currently in the process of constructing a link to their transmission system, which will connect BIPCO to the mainland grid. The subsea and overhead 34.5 KV conductors have been installed, and National Grid is now constructing the substation on BIPCO property. Deepwater Wind is constructing a (5) turbine, 30 MW wind farm 2.4 miles offshore of Block Island. Deepwater Wind's subsea and overhead 34.5 KV conductors have also been installed, and Deepwater is also now constructing their substation adjacent to BIPCO property. Deepwater Wind has set up a temporary generation and micro grid facility to supply power to the turbines for commissioning. This is on BIPCO property.

Generators

BIPCO has (5) diesel operated generators for normal operation. #24 and #25 are operational. It was reported that #22 threw a rod in the early morning of July 23, 2016, which created a fire. #23 and #26 were damaged by the fire. It is assumed that #22 will be a total loss: Caterpillar is in the process of evaluating #23 and #26. Based on their recommendation, as well as input from the insurance company, a decision will be made on these two.

#24 and #25 were inspected while running with no apparent issues. Although not pristine, they appeared to be well maintained, and the building was also adequate for the operation.

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Upon questioning the BIPCO personnel, they advised that BIPCO performs hourly inspections, regular routine maintenance and the 500-hour service, in accordance with Caterpillar recommendations. Review of available service records for 1/1/15 to the present, confirmed that most 500-hour service was performed. 1/1/15 is when BIPCO began keeping this type of record. As can be seen from the chart below, there is evidence that some service was significantly late, or not recorded in the service notebook

#25	Hours	Interval	#24	Hours	Interval	
	30482			44536		
	31047	565		45550	1014	
	32124	1077		46060	510	
	32659	535		47022	962	
	33135	476		47700	678	
	33530	395		48247	547	
	34095	565		48370	123	4000 hr service
	34606	511		48883	513	
				49433	550	

A Caterpillar service technician was on site for the evaluation of the fire. He was the technician who performs most of the factory service for BIPCO. The technician confirmed that BIPCO generally calls for service beyond the 500-hour service. Due to a number of circumstances, BIPCO has performed more complex service at times.

It is important to note that the rod could have been thrown due to old age, it could also have been the result of a service error. If the information on the reason for the failure is determined to be BIPCO/Caterpillar service, then it must be assumed that the same type of problem could be repeated. The building housing #22, #23, #26 was severely damaged by the fire. The roof and insulation would be a total loss. There is evidence of possible structural damage caused by excessive heat. If the building is to be reused, there is significant work required to get it back to a safe condition.

Each generator has a day tank for the diesel it uses. Diesel is continuously pumped to the diesels, and a high proportion is returned. An alarm panel is located in the control house to facilitate quick response to day tank failures.



Temporary Generators

In order to continue to supply power to the island BIPCO contracted with Caterpillar Milton to supply two trailer mounted generators capable of 2 MW each. According to BIPCO management, the transformer capabilities were less than the total of 4 MW which was available, because of availability of transformers for immediate delivery. It was reported that larger transformers were enroute, to bring these generators up to full potential. The temporary generators were interconnected to the substation bus, with appropriate isolation disconnects. Because this was a temporary situation, these were not evaluated as part of the assets of BIPCO.



Service Vehicles

Three BIPCO line trucks were parked in the other section of the generator building that sustained a fire. It was reported, and evident to a casual observer, that one truck had significant heat related damage. Due to age and condition of the truck before the fire, and the fire damage, it is expected that this truck will be a total loss. The other two line trucks had visual damage to some degree, but appeared to be serviceable. BIPCO plan is to have the local Ford dealer get the truck back in service so it can be driven to the bucket equipment manufacturer. The manufacturer will perform a complete inspection and advise what service is required to get it back to a safe and serviceable vehicle.



BIPCO Substation

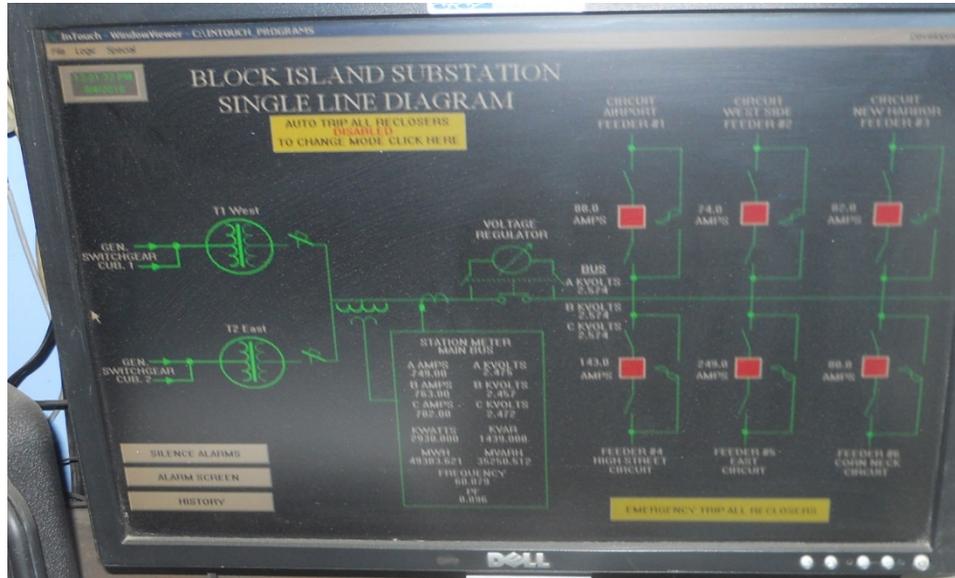


Power is delivered to one of two primary transformers with output to a common buss. Power regulators discharge power to the main distribution buss. From the distribution buss, the substation has six distribution circuits:

1. Airport
2. West Side
3. New Harbor
4. High Street
5. East
6. Corn Neck

A review of the documentation for the substation indicated that the drawings and component information needed for service was readily available. The general condition of the substation looks very well kept up with no obvious safety or maintenance issues. Daily inspections of the substation are performed by BIPCO employees, with annual service performed by Haugland Energy. The last inspection and service was done in January 2016, with several recommendations made. (See Attachment for the letter report.) Upon questioning BIPCO management, it was determined that **none of the recommendations had been completed**. BIPCO management reported that parts were on backorder. Because annual service and maintenance is necessary to discover hidden problems, this could indicate a potential reliability of safety issue for the facility.

The substation is monitored via a fiber optic link by the Substation computer. From this screen, breakers can be operated remotely, and other key parameters can be monitored. As shown below, the distribution buss is shown to be at 2.574 kV.



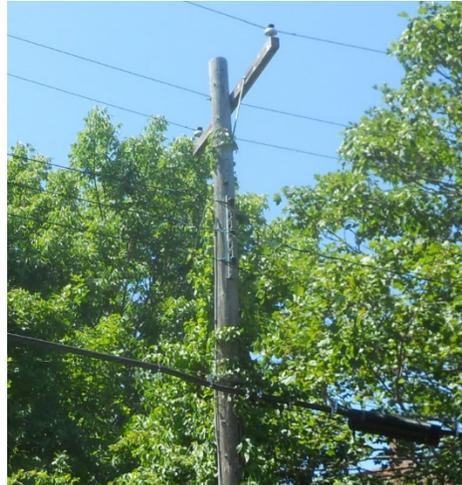
It was reported that Engineering had been completed to interconnect to the new National Grid Substation. It was reported that engineering was submitted to National Grid for approval. It was reported that National Grid wanted a redundant power transformer, which BIPCO had not included. Engineering was not available for review during the site visit.

Distribution System

As stated above, there are six distribution circuits, each supplied via a different breaker at the substation. One set of pole mounted line voltage regulators are present on each circuit. All circuits are set up in a three phase configuration with each single phase residential or commercial drop coming from two legs. No three phase services were observed, due to only a cursory inspection being performed. The distribution system is operated at 2.4 kV, which is atypical for this type of application, and there is an expectation of higher than normal losses. Discussions, and preliminary planning have occurred to increase the system voltage to 4.1 kV, but no schedule has been set and engineering has not started.

It was reported that the complete system uses a GE smart meter system for billing as well as dispatch to line crews. The GE system, which became operational in the last 18 months, pages the line crew if voltage is detected as low, beyond a time threshold set by the operator. It was reported that this worked well for both billing and paging.

A limited inspection of two distribution lines indicated that maintenance, especially vegetation trimming was being neglected. The picture below shows conductors touching vegetation as well as vines growing right up to the crossbars.



It was reported by the receptionist and bookkeeper at the BIPCO headquarters, that there are very few complaints from the customer base. She reported that when calls are received for power outages, the line crew is already on the way due to the GE smart meter paging. She could not remember the last time a customer had reported voltage or frequency issues which were blamed for damage to computers and other electronics.

Inspection of several wooden poles indicated that they were weathered and showing the effects of many years in service. Evidence of erosion, due to wind, rain, and sleet were seen on many poles, with poles near the coast showing much higher levels. Line crews were not available for questioning, so an estimate of the number of pole failures per year was not available.

Diesel Oil Tanks

BIPCO has several underground diesel fuel oil tanks, all monitored from a remote panel in the control house. It was reported that all tanks must be removed, by order of the US EPA. One group reported the deadline was 12/31/16 and another reported the deadline had been extended to 12/22/17 or 1/1/18. A new owner must be prepared for this expense.



It was reported by operators that a historical diesel leak had occurred. Monitoring wells are in place with regular testing. It was reported that testing indicates the problems is getting smaller. The environmental inspection will review this more completely,

Cell Tower

There is a cell tower located on the site, which appeared to be in good condition with no immediate areas for concern. It was reported to be owned by BIPCO with space leased to Verizon, ATT, Sprint, Cingular, and one or two radio stations. It was reported that the tower was originally constructed by one of the radio stations, but ownership transferred to BIPCO, at a later date. It was reported that annual inspections and service were performed by Northeast Towers Inc.. There were no records of the inspections available to review.



National Grid Cable and Substation

National Grid has installed a subsea cable connecting their mainland transmission to Block Island. The subsea cable, the underground Block Island cable and the overhead BIPCO property line have been installed. National Grid is currently constructing a substation on property it has purchased from BIPCO on the BIPCO site, for the purpose of supplying power to BIPCO and to the Deepwater Wind project. No evaluation of this were performed.



Deepwater Wind

As part of their 30 MW offshore wind project, Deepwater Wind has installed its own subsea cable. Using a common landing point, and constructed in tandem with National Grid, Deepwater has also installed their underground Block Island cable and the overhead BIPCO property line. Deepwater Wind

and National Grid share the transmission line corridor on the island. Deepwater Wind is constructing its own substation, immediately adjacent to the National Grid substation on land it has purchased from BIPCO on the site. In addition, Deepwater Wind has installed a temporary Micro Grid to energize the turbines during commissioning. The Micro Grid was connected temporarily to the Deepwater Wind overhead line. It was reported that this line was not yet energized.



Summary

The BIPCO site is very complex at this time, but it appears to be well managed with limited immediate concerns supplying power to the island. The areas which the Town of New Shoreham needs to address are:

1. Resolution of the insurance claims for the generators and line vehicles needs to be completed, and the net cost to replace the line vehicles needs to be determined.
2. Adherence to the recommended service schedule for the generators needs to be improved.
3. A determination on the level of backup power, after connection to National Grid needs to be done and the net cost to replace the generation needs to be determined.
4. Substation maintenance recommendations need to be implemented.
5. Cell tower inspection records need to be located and reviewed.
6. The engineering for the interconnection to National Grid needs to be finalized and approved by National Grid. The cost for the upgrades needs to be reported to the Town.

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Attachment: Haugland Energy



Executive Summary
Block Island Power Company
Substation Maintenance 2016

During the month of January of 2016, the following observations were made while performing routine inspection and maintenance of the Main Substation Equipment for the Block Island Power Company.

All testing was performed in accordance with the manufacturer's specifications and/or NETA Maintenance Testing Specifications (NETA MTS-2015).

1. Infrared Scan:

The Medium Voltage Metal Clad Switchgear Lineup, and all of the equipment in the MV Substation were Infrared scanned.

No exceptions were taken during the Infrared scanning and no deficiencies were observed with this equipment at this time.

It is recommended that any future Infrared scanning be performed during maximum load periods.

2. Main Power Transformers:

The (2) two Main 5000 KVA Power Transformers were inspected and an Oil sample and a Dissolved Gas sample was taken for lab analysis for each unit.

The following electrical testing was performed for each unit:

- Power Factor Test
- Excitation Test
- Bushing Hot Collar Test
- Turns Ratio Test
- Insulation Resistance Test
- Winding Resistance Test

The following observations were made:

T1 Transformer:

- The compound pressure/vacuum gauge was found to be illegible. This device was replaced and no further action is required for this device.
- No exceptions were taken with any of the electrical test results.

T2 Transformer:

- The compound pressure/vacuum gauge was found to be damaged. This device was replaced and no further action is required for this device.
- No exceptions were taken with any of the electrical test results.



3. Voltage Regulators:

The (3) three, 333 KVA Voltage Regulators were inspected and an Oil sample and a Dissolved Gas sample was taken for lab analysis for each unit.

Due to system constraints no electrical testing was performed for any of the three Voltage Regulators.

The Disconnect/Bypass Switches for the Voltage Regulators are not operating as designed and it had been previously witnessed by utility personnel that the By-Pass section had open circuited during a switching operation.

The Voltage Regulators must be "Isolated and By-passed" to perform any electrical testing when the system is "On-Line".

The Disconnect/Bypass switches are made by Cooper Power Systems. The model type is HH-72.

The Disconnect/Bypass Switches will need to be repaired and/or replaced to permit electrical testing for these Voltage Regulators.

The Voltage Regulators were inspected and the following observations were made:

Voltage Regulator A phase:

- This device was low on insulating oil. This device has a leak on the radiator assembly. The customer has applied a sealant to the leak with some success, but the leak has not been completely mitigated.
During a planned system outage this device with filled with approximately four gallons of customer supplied insulating fluid.

Voltage Regulator B phase:

- No defects were observed.

Voltage Regulator C phase:

- One of the (3) three terminal bushings is damaged. A portion of the "Load Bushing" skirt is broken off. It is undetermined at this time if this will have any effect on the future proper operation of this unit.

4. Circuit Reclosers:

There are (6) six Circuit Reclosers. All (6) six are identical in make, model, year of manufacture and installation date.

The following electrical testing was performed for each unit:

- Over Potential Test
- Vacuum Integrity Test
- Insulation Resistance Test
- Contact Resistance Test
- Function Test



The following observations were made:

Recloser Feeder Circuit No. 1, Airport Circuit:

- **This device did not meet the minimum Insulation Resistance test values as displayed in NETA MTS-2015.**
- This device did pass all other manufacturer and NETA test requirements.

Recloser Feeder No. 2, West Circuit:

- **This device did not meet the minimum Insulation Resistance test values as displayed in NETA MTS-2015.**
- This device did meet the minimum Over Potential test values as displayed in the manufacturer's instruction manual (Cooper S280421), but the recorded test values are significantly higher than similar apparatus.
- This device did pass all other manufacturer and NETA test requirements.
- This device was found with a faulty control box and is presently out of service. The customer has ordered replacement parts and will perform repairs with utility personnel.

Recloser Feeder No. 3, New Harbor Circuit:

- No exceptions were taken with any of the electrical test or function test results.

Recloser Feeder No. 4, High Street Circuit:

- No exceptions were taken with any of the electrical test or function test results.

Recloser Feeder No. 5, East Circuit:

- No exceptions were taken with any of the electrical test or function test results.

Recloser Feeder No. 6, Corn Neck Circuit:

- No exceptions were taken with any of the electrical test or function test results.

Recommendations:

1. Recommend the customer perform a yearly Infrared Scan under high load periods.
2. Recommend the customer take a yearly Oil sample and a Dissolved Gas sample of all oil-filled equipment.
3. Recommend the customer repair and/or replace the defective Voltage Regulator Disconnect/By-pass Switches as soon as practical.
4. Recommend the customer inspect and test the Voltage Regulators once the Disconnect/By-pass Switches are repaired or replaced.
5. Due to system constraints the customer must arrange for a system outage to service the Medium Voltage Metal Clad Switchgear line-up. The time estimate to perform this work is approximately (8) eight hours.
Recommend the customer arrange for this outage at the earliest possible convenience.



6. Recommend the customer replace the Feeder No. 2 Automatic Recloser as soon practical, but no later than (1) year from this date.
7. Recommend the customer replace the Feeder No. 1 Automatic Recloser as soon practical, but no later than (2) years from this date.