

Undertaking 118

Re: general manager of gas turbines and diesels and the mechanical engineer discussed

Undertake to provide with whatever emails, reports, et cetera, that came from the individuals that you just identified.

As there was overlap in the site visits between the AMEC third party inspectors and the Hydro engineers (General Manager of Gas Turbines and two Hydro Mechanical Engineers), the Hydro engineers did not prepare a separate inspection report. Instead, the Hydro engineers participated in the review of the AMEC report and findings. Below are the emails related to Hydro's review of the AMEC inspection report.

EMAIL 1:

From: "Seckington, Blair R" <Blair.Seckington@amec.com>
To: @amec.com
Cc: @nlh.nl.ca" @nlh.nl.ca", @nlh.nl.ca" @nlh.nl.ca>
Date: 04/30/2014 02:42 PM
Subject: Nalcor GT Inspection/Review - Initial Feedback - Seckington

x,

As discussed here are my initial thoughts:

- There are five areas where five areas of storage at the Barnhart 1701 Dunn Street facility and one off-site at its Port Barge Unloading facility.
 - Indoor enclosed – (i.e. insulation, IPB equipment, burner assembly materials, exhaust transition)
 - Indoor – roof but not enclosed – (i.e. oils/greases/misc, bulk piping and large inlet/outlet ductworks)
 - Climate controlled – enclosed and heated/humidity ctrl – (i.e. controls, computer hardware, printers, DCS)
 - Outdoor – exposed outdoors - fin fan coolers for generator and lube oil; lube oil skid, electrical skid
 - Outdoor – exposed – bulk structural items, duct materials
 - Off-site port storage building for gas turbine and generator storage - enclosed
- The equipment storage appears to have been effectively managed
 - No areas of free standing water or appearances indicating no leaks on equipment and parts, particularly in covered areas
 - No significant rusting, corrosion of various parts

- Pipes and opening appear to have been effectively sealed
- Undisturbed dust coating in some areas indicate that equipment has not been disturbed or moved
- No evidence evident of vermin or birds nesting in equipment
- Equipment can be effectively traced between various inventory documentation
- Maintenance efforts appear to have been effectively focused on equipment requiring heating, dehumidification, turning
 - GT is dehumidified and records monitored/maintained
 - Generator has power to its heating coil circuits
 - Fin fan coolers are periodically turned
 - Heaters are on in various equipment
 - Computer and sensitive control equipment kept in climate controlled room
 - GT and generator management is consistent with Siemens instructions
- Maintenance records indicate that the maintenance and monitoring of the stored equipment has been ongoing
- An indicative walk-down comparison with a summary inventory list indicates that critical equipment is stored and identified in original inventory activities. Upon project activation, a detailed inventory and sequence plan would be done by Energy Parts as part of their EPC implementation process.
- The GT seems in good condition in terms of its visible external elements. The humidification system was operational during the visit
- The generator was completely boxed up, but with power to its heating elements – likely more desirable than opening for a visual check
- The GT and generator rotors are not turned, which is apparently consistent with Siemens laid up new unit practice
 - Would require extensive support systems to be in-place and operating (i.e. lube oil, motor)
 - Would likely expose equipment to elements (vs boxed up)
 - Any issues with rotor bowing would be minimal and worked out during initial start-up/commissioning
- Impressed with apparent capabilities and experience of Energy Parts and its site representative
 - Client focus, implementation of more complex/worse condition systems
 - Internal capabilities re fabrication, spares, engineering
 - Focus on building it as though they are owners/operators

Given that the plan now is to use diesel/#2 oil as the fuel, I am less concerned with the fuel at Holyrood (versus trying to use existing #6 oil). Energy Parts experience should result in a modified fuelling system consistent with its use. It is evident that they also are looking at air intake and filter materials that would be more consistent with salt water environment at Holyrood versus the original design of the stored equipment/materials.

One thought is how has the NOx emissions requirements been defined. The suitability of the existing water injection system is one issue that is outside of scope of my assessment, but should be considered (as I am sure that it has).

Hope this suffices as a summary of my initial thoughts, if you want to discuss Thursday, I can be reached in Vancouver on my cell. I have copied for expediency to x and x.

Blair Seckington
Director, Power Consulting
AMEC

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EMAIL 2:

From: /NLHydro
To: "Seckington, Blair R" <Blair.Seckington@amec.com>
Cc: @nlh.nl.ca>, "Seckington, Blair R" <Blair.Seckington@amec.com>, @amec.com>, @nlh.nl.ca" @nlh.nl.ca>, @amec.com>
Date: 05/01/2014 09:41 PM
Subject: Re: Nalcor GT Inspection/Review - Initial Feedback - Seckington

Hi Blair;

We met up with x & x this morning and viewed the CTG and associated components. Basically our findings are consistent with yours. We were very impressed with the condition of the equipment and didn't have any issues.

regards;

, P.Eng.
Mechanical Design Engineer
NF Hydro

EMAIL 3:

From: /NLHydro
To: "Seckington, Blair R" <Blair.Seckington@amec.com>
Cc: @NLHYDRO, @NLHydro, @NLHydro
Date: 05/30/2014 02:48 PM
Subject: 100 MW CTG - Draft 3rd Party Inspection Report Comments

Hi Blair;

Attached is my review of your draft 3rd Party inspection report using track changes.

, P.Eng.

Mechanical Design Engineer

NF Hydro



5 May 2014

Mr. Stephen Parsons, P. Eng.
Project Manager
NALCOR Energy
Hydro Place, 500 Columbus Drive
PO Box 12800
St John's, NL, Canada
A1B 0C9

Dear Stephen,

Newfoundland and Labrador Hydro – GT Inspection Assessment

As per our Agreement, we have completed the draft report of the Newfoundland and Labrador Hydro GT Inspection Assessment. I trust that the report satisfies your needs.

Overall it seems that the Siemens D5A GT has been reasonably stored and the storage requirements of specific systems such as dehumidifying the GT and electrical skid, internal heating of generator, and heating/turning of various motors have been regularly undertaken and monitored. Pipes and openings have been sealed to minimize exposure to vermin. Based on the inventory of parts, the stored materials appear to be complete (at least major elements). Overall the condition of the parts of the units appear to be in good condition, consistent with preserving the life of the major parts of the unit.

Thank you for the opportunity to work on this very interesting project.

Yours truly,

Blair Seckington
Director, Power Technology
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BRS/brs

c: G. Forbes C. Woodall

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Newfoundland and Labrador Hydro GT Inspection Assessment

May 05, 2014

Newfoundland and Labrador Hydro GT Inspection Assessment

Prepared by: Blair Seckington 05 May 2014
Blair Seckington Date

Checked by: Joe Garren 05 May 2014
Joe Garren Date

Approved by: Blair Seckington 05 May 2014
Blair Seckington Date

Rev.	Description	Prepared By:	Checked:	Approved	Date
A	Draft Report	Blair Seckington			5 May 2014

Newfoundland and Labrador Hydro a NALCOR Energy Co.
Newfoundland and Labrador Hydro Facilities Winter Readiness Review



05 May 2014

P176745 Revision A



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NEWFOUNDLAND AND LABRADOR HYDRO FACILITIES WINTER READINESS REVIEW

1 INTRODUCTION/BACKGROUND

Newfoundland and Labrador Hydro (NL Hydro) ~~have~~ has an interest in procuring and installing a previously owned (not used) gas turbine (GT) unit for service at the Holyrood Thermal Generating Station (Holyrood). ~~As a part of that process they have identified a suitable Siemens 501D5A/SGT6-3000E gas turbine~~ (originally designed for natural gas) is available from ProEnergy/Energy Parts as a component part of ~~an~~ a recently submitted EPC proposal ~~that would be suitable~~. The unit is currently stored at the Barnhart Crane & Rigging facility ~~Company's Memphis Branch~~ located at 1701 Dunn, Memphis, Tennessee.

AMEC was contracted to undertake a third party visual inspection/assessment of the unit to determine if ~~the unit~~ has been stored properly and its storage managed in such a way as to maintain its viability for service in Newfoundland, and to provide an opinion on its suitability for service at the Holyrood site.

The ProEnergy/Energy Parts ~~Contact~~ contact for the site review was Bob Dodson (880-281-5433) while Barnhart's site contact was Jeff Smith.

The major component information is:

Combustion Turbine

Combustion Turbine Model	SGT6-3000E
Serial Number	37A7750
Year of manufacture	2007

Comment [TC1]: Include manufacturer

Generator

Generator Model	SGEN6-100A-2P
Serial Number	12009742
Rating	120 MVA, .90pf (@40 degrees C
Year of manufacture	2009

Comment [TC2]: Include manufacturer

Expected Performance:

Net GT Power 102.9 MW
Net GT Heat Rate 10,289 BTU/kwh

Comment [TC3]: Put the expected performance information in a table.

For 14.271 psia, Inlet air temperature 95F, Relative Humidity 80%
And evaporative cooler ON, and fuel lower heating value 20,981 BTU/lb LHV

Comment [TC4]: Include in a table.

The equipment has been in storage since approximately October 2009. The storage and preservation activities have been provided by Barnhart in accordance with the guidelines specified in the manufacturers "Storage, Preservation and Rehabilitation Manual for Econopac Systems" (SPM-2000 v5).

2 SCOPE AND FACILITIES AND METHODOLOGY

The key AMEC work tasks included:

- i) ~~pre~~ pre-site visit review of ProEnergy/Hydro provided information;
- ii) ~~a~~ visual assessment of GT at the storage site; and

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iii) The preparation of a letter report summarizing site observations and providing an opinion of suitability of the unit for use at Holyrood.

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The specific work tasks included:

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- ~~A Review~~ review of the original PO/specifications for the ~~CTG~~ CTG, if available.
- ~~A Review~~ review of vendor documentation with the CTG such as drawings and manuals to confirm whether or not the proper documentation had been shipped with the CTG and to identify ~~any~~ data gaps.
- ~~A Review~~ review of storage maintenance records.
- ~~A Review~~ review of CTG storage procedures and how it was laid-up.
- ~~A General~~ general inspection of the storage facility and storage conditions.
- ~~A Visual~~ visual inspection of all CTG components, obtaining nameplate information, etc.
- Identification of ~~any~~ visually obvious defects in the CTG.
- ~~A Review~~ review of ProEnergy's proposal to assess the suitability of the CTG to operate in the Holyrood climate.
- Completion of a photographic log at the storage facility.
- ~~A Meeting~~ Meeting with Nalcor and ProEnergy ~~representatives on-site~~ and
- ~~The Preparation~~ preparation of a stamped letter report that includes:
 - A summary of findings and observations.
 - Consolidation of vendor and storage information.
 - Identification of potential climate and/or code issues associated with the operation of the combustion turbine generator at Holyrood, as compared to the location for which ~~is~~ it was originally designed ~~to be operated in~~ and
 - An opinion of suitability of the CTG.

Comment [TC5]: We are referring to CTG here and GT above.....should be consistent with either GT or CTG.

Comment [TC6]: Use an acronym consistently here

3 REVIEW OF DOCUMENTATION

3.1 Design Information and Pre-Site Visit Data

There was ~~little limited~~ data available ~~to review~~ prior to the site visit. After the site visit, a brief review of documentation provided by Nalcor and ProEnergy included:

- ~~A Review~~ review of the original PO/specifications for the CTG, ~~if available~~ ~~None were available for review during the period~~ and
- ~~A Review~~ review of vendor documentation with the CTG ~~included including a~~ Siemens List of documents, drawings, specifications, commissioning manual, instruction manuals, O&M manuals, installation manuals, ~~and Equipment~~ equipment lists- equipment description.

It ~~appears appeared~~ that fairly extensive information ~~has had~~ been shipped with the CTG and ~~has been or~~ can be provided to Nalcor upon procurement of the machine. ~~No~~ specific gaps were identified within the time available, although additional data on the fuel oil firing systems will be required when that is engineered and installed by ProEnergy.

Comment [TC7]: Reword this sentence

3.2 Storage Procedures and Lay-up and Maintenance Records

The equipment has been in storage since ~~approximately~~ October of 2009. The storage and preservation activities have been provided by Bamhart in accordance with the guidelines specified in the manufacturers "Storage, Preservation and Rehabilitation Manual for Econopac Systems" (SPM-2000 v5). A copy of an extract from SGT6-3000E COMBUSTION TURBINE AND GENERATOR PRESERVATION

AND STORAGE I.L. 1700-0007-SGT6-3000E-STD Rev 1 is attached. Barnhart had an equipment storage document procedure developed by Sargent & Lundy for the storage of this equipment unit which has been followed since October of 2009 and follow it.

ProEnergy provided data from Barnhart on the maintenance and monitoring records. These included the following documents:

Comment (TCI): Use consistent font size.

Code	System/Equipment	Frequency	Type	Scope
22100	Maintenance Tools	3 Monthly	Walk Down	Rust, Vermin, General
22200	Service Lifts Assembly	3 Monthly	Walk Down	Rust, Vermin, General
33000	Starting Package	Monthly	Inspect/Test	Rotate motors, check amps
50000	Lube Pump, compressor	3 Monthly	Inspect/Test	Humidity, temp, Other
81050	Inlet Duct materials	Monthly	Walk Down	Rust, cribbing, supports, vermin, etc
83050	Covered area Piping	Monthly	Walk Down	Rust, cribbing, supports, vermin, etc
Area 924 Outside	Lube oil & gen fans, elect package	Monthly	Inspect/Test	Motor turn, Amps, inspect
Area 972 Inside	GT Enclosure Fans (& gas system)	Monthly	Inspect/Test	Motor turn, Amps, inspect
Turbine & Generator	Gen & GT	Monthly	Inspect/Test	Humidity, Rust, vermin, heaters, etc.
500000 Meggering	Mechanical package	3 Monthly	Meggering	Meggering motors
5000000 Weekly	Mechanical package	Weekly	Inspect/Test	Humidity, temperature

Based on these records, it appears that the equipment is being monitored on a regular basis and that conditions are maintained appropriately.

4 SITE INSPECTION

4.1 Storage Facility

There are five areas where five areas of storage at the Barnhart 1701 Dunn Street facility and one off-site at its Port Barge Unloading facility.

- o Indoor enclosed – (i.e. insulation, IPB equipment, burner assembly materials, exhaust transition)
- o Indoor – roof but not enclosed – (i.e. oils/greases/misc, bulk piping and large inlet/outlet ductworks)
- o Climate controlled – enclosed and heated/humidity ~~air~~-controlled – (i.e. controls, computer hardware, printers, DCS)
- o Outdoor – exposed outdoors - fin fan coolers for generator and lube oil; lube oil skid, electrical skid
- o Outdoor – exposed – bulk structural items, duct materials
- o Off-site port storage building for gas turbine and generator storage – enclosed

The equipment inventory is well maintained, and equipment appeared to be where it was identified as being. The ability to store materials in suitable environments (climate controlled, heavy lift, enclosed, open/covered, outdoor) is evident and appears to have been reasonably employed.

4.2 Visual Inspection of CTG Components

An indicative walk-down and visual inspection of the CTG components was undertaken, tracking major items against the summary inventory list for the AECI Essex II Siemens list provided by ProEnergy. The following was noted:

- Major pieces of equipment per the inventory list were accounted for using identifiers on packing slips or other equipment documentation. (NOTE: Upon project activation, a detailed inventory and sequence plan would be done by ProEnergy/energy parts as part of their EPC implementation process.)
- Loose items were stored appropriately. ~~Pipes and openings appear to have been effectively sealed~~
- ~~pipes/Pipes~~ and other openings were sealed where practical
- No areas of free standing water or appearances indicating ~~no~~ leaks on equipment and parts, particularly in covered areas
- No significant rusting ~~or~~ corrosion of various parts
- Undisturbed dust coating in some areas indicate that equipment has not been disturbed or moved
- No evidence evident of vermin or birds nesting in equipment
- Major pieces of equipment requiring special provisions (requiring heating, dehumidification, turning) appear to have been effectively addressed.
 - GT is dehumidified and records monitored/maintained
 - Generator has power to its heating coil circuits
 - Fin fan coolers are periodically turned
 - Heaters are in service on ~~in~~ various equipment
 - Computer and sensitive control equipment kept in a climate controlled room
 - GT and generator management is consistent with Siemens instructions
- The GT seems in good condition in terms of its visible external elements. The humidification system was operational during the visit
- The generator was completed boxed up, but with power to its heating elements – likely more desirable than opening for a visual check
- The GT and generator rotors are not turned, which appears consistent with Siemens lay-up ~~practice/practices~~.
 - Would require extensive support systems to be in-place and operating (i.e. lube oil, motor)
 - Would likely expose equipment to elements (vs boxed up)
 - Any issues with rotor bowing would be minimal and worked out during initial start-up/commissioning
- Impressed with apparent capabilities and experience of ProEnergy/energy parts and its site representative.
 - Client focus, implementation of more complex/worse condition systems
 - Internal capabilities re fabrication, spares, engineering
 - Focus on building it as though they are owners/operators

Comment (TC9): Include this document in an appendix

The ability to obtain nameplate information was limited due to the packaging associated with most of the equipment (including the generator). The gas turbine nameplate was photographed and included in a photographic record in Appendix 1.

4.3 Photographic Record

A summary level photographic record was undertaken during the review. Given the scope and layout and timing, it is not intended as an exhaustive record. It is indicative of the manner in which equipment is being stored and its condition. It is included in Appendix 1. (Other photographs were taken and could be made available if desired.

5 SUITABILITY OF EQUIPMENT FOR HOLYROOD SITE APPLICATION

ProEnergy identified that Nalcor plans to use No 2 diesel/#2 oil as the fuel oil for this GT equipment at Holyrood ~~(as opposed to the heavy fuel oil (HFO) that is currently used for the thermal units at the Holyrood site and which had been considered earlier by Nalcor for a GT at the site)~~. This will require a new fuel handling system and burner system to be provided by ProEnergy since the existing GT was

designed and stored as a natural gas unit. The ~~oil fuel/fuel oil~~ is not a significant issue for the rest of the GT or balance of plant, ~~it~~ but will result in more frequent GT maintenance, ~~(but much less than for HFO).~~

ProEnergy/Energy Parts are also looking at air intake and filter materials that would be more consistent with the salt water ambient air environment at Holyrood versus the original design of the stored equipment/materials. Provided this addresses the issue appropriately, this issue is not a showstopper, but also may require additional monitoring and maintenance over the longer term.

The ProEnergy/Energy Parts site representative also indicated that they are providing a black start capability for the unit that is not a part of the current system. This would provide additional flexibility for emergency conditions.

One question that remained after the site visit was what are the NOx emissions requirements and how are they addressed. The original equipment had a water injection system for NOx control on natural gas (may also have been useful for power augmentation). Given NOx increases with fuel oil use, it may be ~~that the necessary to increase the~~ water injection rate ~~might need to be increased~~. This could result in a modest equipment change for the water injection system. The suitability of the existing water injection system is an issue that is outside of scope of this assessment, but should be considered.

6 CONCLUSIONS

Overall, the existing Siemens 501D5A/SGT8-3000E gas turbine visited seems in good condition and to be a suitable candidate for an application at Holyrood TGS.

1. The storage and condition monitoring of the existing GT equipment has been and is being well managed, including equipment requiring special provisions and testing.
2. The walk down indicated that the equipment stored appears to be consistent with the inventory list supplied by ProEnergy.
3. No significant equipment damage was identified during the walk downs.
4. Computer equipment in the climate controlled room appears well preserved, but may be obsolete and ~~be replaced~~ require replacement by newer systems.
5. The equipment should be suitable for application at ~~the~~ Holyrood TGS site, provided:
 - a. The liquid fuel system to be provided by ProEnergy is suitable (For which they do have experience and capability based on discussions with their site representative.)
 - b. The air intake system and air filter materials are modified so as to be suitable for a salt water ambient air environment
 - c. The black start proposed to be added to the existing equipment is integrated into the overall scheme.
 - d. The NOx emissions capability requirements can be met by the existing water injection system or require a modification to the system.

Comment [TC10]: I wasn't aware that it was modified already.



APPENDIX 1
Site Photograph Journal

APPENDIX 2

Site Siemens Long term lay-Up Guide Photograph Journal



Turbine and
Generator Preservati

APPENDIX 3

Document Reference

To be added?