From: Hantz Presume
Sent: Thursday, May 18, 2017 9:21 PM
To: Josh Castonguay
Cc: Chris Root
Subject: Northern Vermont improvements

Josh,

Attached is a letter that provides the amount of additional power that KCW would be able to generate if the proposed changes are implemented. The MW increase is expressed as a range, but you can use the top end of the range for a cost/benefit analysis.

I am also attaching the cost estimate and design for the cross trip scheme. The scope is described in the notes. As I mentioned before, this scheme will likely not be accepted by ISO-NE. The voltage regulation option has a better chance of being accepted, but will require an ISO-NE study. Hopefully, Sheffield will not need to submit an interconnection request for the additional reactive capability.

Let me know if you have any questions.

Hantz.

vermont electric power company
VELCO

May 18, 2017

Mr. Josh Castonguay
Chief Innovation Executive
Green Mountain Power
163 Acorn Lane
Colchester, VT 05446

Re: Potential T&D solutions to the SHEI export constraints

Dear Mr. Castonguay:

As requested, VELCO has reviewed three options for increasing the SHEI export limits. Until ISO-NE can update the limits, the export limit improvements and the corresponding increases in wind generation determined in this VELCO analysis should be considered as estimates, which were identified by comparing system performance under all-lines-in conditions before and after the studied changes and are only relevant for the conditions studied. The benefits of the tested solutions will be reduced or could be eliminated under certain outage conditions and other operating conditions. As we implement these system changes, the transmission system will become thermally limiting under certain conditions. Below is a table summarizing the results of the power flow analysis. For the purpose of conducting an economic analysis, it is appropriate to use the upper end of the MW ranges, which should be achievable under most conditions.

Solutions	Estimates of wind generation increase	Notes
Reconductor the B20 line from 4/0 ACSR to 795 ACSR and upgrade the Lowell 46/34.5 kV transformer	0 to 15 MW	1
Enable voltage regulation at Sheffield	0 to 10 MW	2
Trip Sheffield with the K39 line	0 to 15 MW	3

1- ISO-NE approval is not required for subtransmission upgrades. However, to fully realize the export limit benefits of the B20 upgrade, ISO-NE needs to recognize the support from the 34.5 kV network when updating the SHEI limits. ISO-NE indicated that the B20 upgrade will be recognized if VELCO is notified of and approves planned 34.5 kV outages days before the outages, and VELCO monitors the status of the 34.5 kV lines, as well as the voltage and current measurements within an area extending to Irasburg, St Albans, Barre and Comerford.

2- Currently, the Sheffield plant regulates its power factor. If the plant's reactive capability can be utilized, it will provide dynamic voltage support through automatic voltage control, which will address the voltage concerns in the area and should allow generators to increase their output as indicated in the above table. Enabling automatic voltage control is a material change, which may require Sheffield to submit a new generation interconnection request to ISO-NE for review and approval by the System Planning staff.

VELCO has been informed that the manufacturer of the Sheffield wind turbines is no longer in business and it has been very difficult to obtain modeling information for this facility.

3- Tripping the Sheffield plant at the same time as the K39 line removes the negative impacts of the plant at the same time as the K39 line disconnection from the Sheffield substation. This change will require an I.3.9 analysis to demonstrate no adverse impact to the system. The Sheffield trip can be achieved in a number of ways, which may or may not be acceptable to ISO-NE:

   a) Install a cross trip scheme that will trip the plant as part of the K39 line protection. Sheffield could be tripped by opening the K47 breaker or the Sheffield 34.5 kV breakers at the same time as the KT1 breaker every time the K39 line is called to open in order to isolate a fault. ISO-NE has not supported such an approach to allow interconnection of power plants because such a system would be deemed an SPS.
   b) Install a special protection system (SPS) that would sense that the K39 line has opened and would subsequently send a trip signal to force the plant to trip by opening the Sheffield 34.5 kV breakers at the same time as the K39 line is called to open in order to isolate a fault, or when both the K39 and KT1 breakers are opened for other reasons. It should be noted that ISO-NE has not supported SPSs to allow interconnection of power plants in lieu of system upgrades.
   c) The Sheffield ring station could be modified by moving the KT1 breaker next to the 47-7 switch between line K46 and the north bus. Tripping the K39 line would immediately cause the disconnection of Sheffield. This reconfiguration of the ring would defeat the purpose of a ring because the K39 line could not be disconnected without requiring the Sheffield plant to also be disconnected.

While each of the above options could individually result in the increase of export capability, the export limit improvements from two or more options would not necessarily be cumulative to each other. For instance, if the B20 line is upgraded and the cross trip is installed to trip the Sheffield plant with the K39 line, it does not mean that the total improvement will be 30 MW instead of 15 MW for the individual options.

Before proceeding with any of these solutions, GMP should consult with ISO-NE to discuss the acceptability of these solutions. For the options that involve or affect the Sheffield plant, GMP should obtain Sheffield's approval before discussing these options with ISO-NE. Should you have any questions, please do not hesitate to contact me.

Sincerely,

Hantz A. Présumé,
Manager, System Planning

Cc: Christopher Root Chief Operating Officer, VELCO

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PROJECT COST ESTIMATE SHEET

Sheffield Line Trip Relay

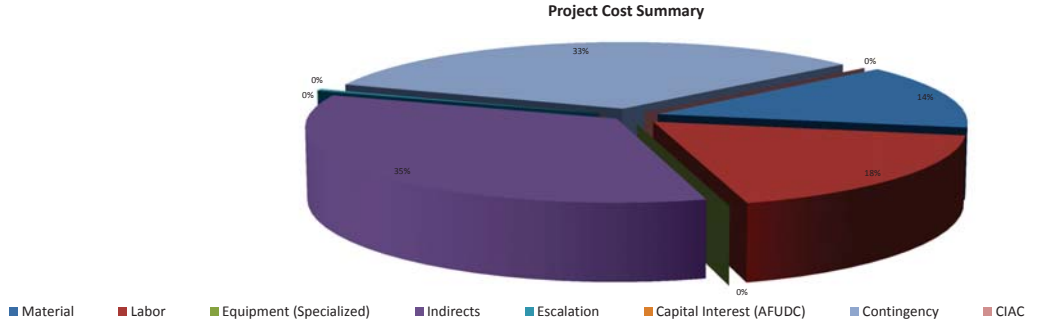
Cost Estimate - Summary Sheet

A - Conceptual Grade Cost Estimate

May, 2017

1. Project Cost Estimate Summary

Project Cost Summary		
Material	$	8,258
Labor	$	10,600
Equipment (Specialized)	$	-
Indirects	$	20,383
Escalation	$	227
Capital Interest (AFUDC)	$	-
Contingency	$	19,734
CIAC	$	-
Total Project Cost	**$**	**59,203**



2. Project Cost Summary by Project Element & Cost Categories

Detailed Cost Summary By Project Element											
Sub-Project Name	Material	Labor	Equipment (Specialized)	Indirects	Escalation	Capital Interest (AFUDC)	**Project Subtotal**	Contingency		CIAC	**Total Project Cost**
1 A.) Sheffield Line Trip Relay	$ 8,258	$ 10,600	$ -	$ 20,383	$ 227	$ -	**$ 39,468**	50%	$ 19,734	$ -	**$ 59,203**
Total	**$ 8,258**	**$ 10,600**	**$ -**	**$ 20,383**	**$ 227**	**$ -**	**$ 39,468**	**50%**	**$ 19,734**	**$ -**	**$ 59,203**

Notes:

1. Assume 50% contingency
2. Assumes Project Completed by March, 2018
3. Assumes Following Scope:

[redacted]

4. Assumes SPS Type III Status
5. Assumes a single telecom path for Lyndonville remote clearing status
6. Assumes no special operating guides or specialized SCADA controls