



Memorandum

To: Thomas Dunn

cc: Planning, Thad Omand

From: Hantz Pr sum 

Date: 2/9/2011

Re: Impacts of opening the B-22 Johnson-Morrisville line

Following the completion of Stowe 115 kV to 34.5 kV substation project, the flows on the B-22 line were reduced. Local distribution utilities have determined that system losses, although lower than prior to the Stowe project, have been higher than expected, and consideration is being given to opening the B-22 line on a normal basis to eliminate these losses. VELCO was retained to document the potential system impacts of opening the B-22 line. Three Vermont load levels were tested: 1150 MW, 820 MW and 700 MW. These load levels were tested assuming 100% of hydro generation, 50% and 10%. The system was then tested with the B-22 line open and closed. Below is a summary of those impacts.

With the B-22 line closed, all voltages remained above 0.9 pu and all line flows were below current carrying capacities for all contingencies tested. Only the K-24/3313 double circuit tower contingency resulted in voltages that were slightly above 0.9 pu with the B-22 line closed, as described in the following paragraph.

The Stowe project was designed with the assumption that all 34.5 kV facilities would remain closed. The initial design proposed that the Duxbury to Stowe 115 kV line would be built separately from the Middlesex to Stowe 34.5 kV line to avoid a common mode failure that would trip both lines. As a result of the permitting process, these two lines were ordered to be on the same towers. Based on the results of the analysis, with the B-22 line closed, loss of both lines resulted in marginally acceptable voltages on the 34.5 kV system with a Vermont load level of 1150 MW. With the B-22 line open, this contingency failed to solve even at a Vermont load level of 700 MW. Other concerns identified with the B-22 line open are noted below.

Loss of the K-24 line (Middlesex to Duxbury to Essex), which includes the Stowe 115 kV line, resulted in a voltage collapse at the 1150 MW load level with 10% of hydro generation. Voltages were unacceptably low with moderate to high hydro generation at the 1150 MW load level.

Loss of the Stowe 115/34.5 kV transformer caused similar concerns as loss of the K-24 line, but they were less severe.

Loss of the East Fairfax transformer caused unacceptably low voltages at the 1150 MW load level with 10% of hydro generation.

Opening the East Fairfax end of the X-29 line (East Fairfax-Johnson) caused unacceptably low voltages at all load levels tested.

Opening the Stowe end of the 3329 line (Morrisville-Stowe) caused a voltage collapse at the 1150 MW load level and unacceptably low voltages at the 820 MW load level.

Opening the Morrisville end of the 3329 line (Morrisville-Stowe) or the entire line caused a voltage collapse at the 1150 MW load level with 10% of hydro generation and unacceptably low voltages with moderate to high hydro generation.

Loss of the Barre transformer caused unacceptably low voltages at the 1150 MW load level with 10% or 50% of hydro generation.

The above results are summarized in the following table.

Load level -->	1150			820			720		
Level of hydro -->	100%	50%	10%	100%	50%	10%	100%	50%	10%
Contingencies	Voltages in percent of nominal								
K24+3313	Collapse	Collapse	Collapse	Collapse	Collapse	Collapse	Collapse	Collapse	Collapse
K24	<0.9	<0.8	Collapse						
Stowe transformer	<0.9	<0.85	<0.8						
3329 Stowe end open	Collapse	Collapse	Collapse	<0.9	<0.9	<0.9			
3329 Morrisville end open	<0.9	<0.8	Collapse						
3329	<0.9	<0.8	Collapse						
Barre transformer		<0.9	<0.9						
K19		<0.9	<0.9						
East Fairfax transformer			<0.9						
X29 E Fairfax end open	<0.85	<0.85	<0.85	<0.85	<0.85	<0.85	<0.9	<0.9	<0.9

Opening the B-22 line will also have negative impacts on the Northwest Vermont Import limit. The B-22 line, as well as most sub-transmission lines, carries network power flows also known as loop flows that do not serve local load. For example, approximately 3% of the Highgate converter output flows on the B-22 line. Import limits are set to prevent system overloads or voltage concerns. If the B-22 line is opened, other lines will carry more power and will be more susceptible to overloads, which will have the effect of reducing the import limits. This reduction will cause more generation to be run when the import limit is reached, which tends to occur during high load levels and system outages.