Connecticut Cable Resonance Study for Synchronous Condenser Option 2 (Case 5d) in Middletown to Norwalk Project

Summary Report
August 2004

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Northeast Utilities
Connecticut Cable Resonance Study for Synchronous Condenser Option 2 (Case 5d) in Middletown to Norwalk Project

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Foreword

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Introduction

GE Energy’s Energy Consulting group has performed a resonance study of “Synchronous Condenser Option 2” (Case 5d) in the Northeast Utilities (NU) Middletown to Norwalk 345 kV transmission cable project that is proposed in southwestern Connecticut. This option connects a 500 MVA synchronous condenser at East Devon 345 kV through a GSU and another 500 MVA synchronous condenser at Singer 345 kV. In this study, the two cables between Norwalk and Singer and the two cables between Singer and East Devon were represented as 3000 kcmil XLPE cable rather than 2500 kcmil HPFF cable, and one of the two HPFF cables between Plumtree and Norwalk was removed.

The objectives of this study were

- to investigate the change in the first resonance with the above modifications as compared to the proposed HPFF double circuit configuration and the XLPE alternative, and
- to investigate the effect of representing reduced generation in the area.

The study has been performed with the Electromagnetic Transients Program (ATP/EMTP), which is recognized as an industry standard for simulating the transient performance and frequency response of electric utility systems [www.emtp.org].

System Representation

The system model used in the Middletown to Norwalk study was used in this study with modifications.

Two 500 MVA synchronous condensers were connected through GSUs: one at East Devon 345 kV and another at Singer 345 kV. The synchronous condenser was modeled as a voltage source behind a subtransient reactance $X_d''$, assumed to be 25% (on 500 MVA base) which is similar to that of 4-pole turbine-generator units.\(^1\) A 500 MVA GSU transformer with 10% impedance (on 500 MVA base) was assumed.

The charging capacitance of the 3000 kcmil XLPE cables is approximately 60% of that of the 2500 kcmil HPFF cables. The following parameters were used to represent the 3000 kcmil XLPE cables (per circuit in pu on a 100 MVA base):

Singer to Norwalk - 15.5 miles
Rpos=0.0003477 pu
Rzero=0.00358118 pu
Xpos=0.00416198 pu
Xzero=0.0023779 pu
Bposzero=1.9637 pu

East Devon to Singer - 8.1 miles
Rpos=0.0001817 pu

Rzero=0.0018715 pu
Xpos=0.00217497 pu
Xzero=0.0012426 pu
Bposzero=1.0261907 pu

In addition to the above changes, one of the two 9.7-mile HPFF cable circuits between Plumtree and Norwalk was removed. The overhead line between East Devon and Besbeck was the same as in the Middletown to Norwalk project.

NU determined that the two capacitor banks at Norwalk 115 kV would be removed with the addition of the Middletown to Norwalk project, and were removed from the model accordingly. Table 1 shows the modified capacitor bank data for this study, and indicates the total MVAR at each bus and the capacitor bank MVAR in service under peak and light load conditions. This study considered conditions with all capacitor banks in service and all capacitor banks out of service. Table 2 shows the generators included in the original ASPEN file, and the modified status originally provided for the Middletown to Norwalk (M/N) project, which indicates the generators that are on or off during peak and light load conditions. An additional generator dispatch scenario is given for “Light Post-Project,” which depicts a more realistic scenario with more local generation off. This study considered the original light load dispatch of generators and the Light Post-Project dispatch with more local generation off.

Table 1. Modified Shunt Capacitor Conditions for System Model

<table>
<thead>
<tr>
<th>Shunt Capacitors</th>
<th>Voltage (kV)</th>
<th># Units</th>
<th>All Banks Peak Load</th>
<th>Light Load</th>
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<td>MVAR (total)</td>
<td>MVAR</td>
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<td>3</td>
<td>157.2</td>
<td>157.2</td>
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<td>Southington 2</td>
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<td>157.2</td>
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* Actual maximum including Glenbrook Statcom is 335 MVAR (additional MVAR not included in analysis)
Table 2. Modified Generator Conditions for System Model

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<tr>
<th>GENERATOR</th>
<th>KV</th>
<th>ID</th>
<th>ST</th>
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<th>STATUS (LIGHT)</th>
<th>Light Post-Project</th>
<th>IDENTIFICATION NOTES</th>
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<td>Light Post-Project</td>
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**Resonance Results**

The resonance effects of Synchronous Condenser Option 2 (Case 5d), including XLPE cables from East Devon to Singer and Singer to Norwalk and removal of one HPFF cable between Plumtree and Norwalk, was analyzed by evaluating the driving-point impedance versus frequency at various locations, with all capacitor banks in and out of service, and with the original light load and light post-project generator (local generation off) dispatches.

Table 3 shows the cases that were performed for Synchronous Condenser Option 2 and the resonant frequencies that were observed along with the corresponding impedance value at those frequencies, with the original light load generation dispatch. The resonant frequency is indicated by its harmonic number (HN), in per unit of 60 Hz, and impedance magnitude is in ohms. The corresponding driving-point impedance plots are provided in Appendix A. Table 4 shows the results with the local generation off (light post-project generator dispatch), and the corresponding driving-point impedance plots are provided in Appendix B.
<table>
<thead>
<tr>
<th>Case</th>
<th>Location</th>
<th>Capacitor Banks</th>
<th>Resonant Frequency &amp; Impedance (pu of 60Hz, Ohm)</th>
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<td>Low HN Z(Ω)</td>
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<td>M/N-XLPE-SC2_1B</td>
<td>Plumtree 345 kV</td>
<td>All in Service</td>
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<td>M/N-XLPE-SC2_1C</td>
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<td>All in Service</td>
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<td>All Out of Service</td>
<td>3.8 23</td>
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<td>All Out of Service</td>
<td>3.8 72</td>
</tr>
<tr>
<td>M/N-XLPE-SC2_6B</td>
<td>Southington 115 kV</td>
<td>All in Service</td>
<td>2.9 12</td>
</tr>
<tr>
<td>M/N-XLPE-SC2_6C</td>
<td>Southington 115 kV</td>
<td>All Out of Service</td>
<td>3.8 10</td>
</tr>
<tr>
<td>M/N-XLPE-SC2_7B</td>
<td>East Shore 345 kV</td>
<td>All in Service</td>
<td>2.9 65</td>
</tr>
<tr>
<td>M/N-XLPE-SC2_7C</td>
<td>East Shore 345 kV</td>
<td>All Out of Service</td>
<td>3.7 70</td>
</tr>
<tr>
<td>M/N-XLPE-SC2_8B</td>
<td>Devon 115 kV</td>
<td>All in Service</td>
<td>2.9 11</td>
</tr>
<tr>
<td>M/N-XLPE-SC2_8C</td>
<td>Devon 115 kV</td>
<td>All Out of Service</td>
<td>3.8 13</td>
</tr>
<tr>
<td>M/N-XLPE-SC2_9B</td>
<td>Frost Bridge 115 kV</td>
<td>All in Service</td>
<td>3.0 20</td>
</tr>
<tr>
<td>M/N-XLPE-SC2_9C</td>
<td>Frost Bridge 115 kV</td>
<td>All Out of Service</td>
<td>3.8 13</td>
</tr>
<tr>
<td>M/N-XLPE-SC2_10B</td>
<td>Glenbrook 115 kV</td>
<td>All in Service</td>
<td>2.9 16</td>
</tr>
<tr>
<td>M/N-XLPE-SC2_10C</td>
<td>Glenbrook 115 kV</td>
<td>All Out of Service</td>
<td>3.8 17</td>
</tr>
<tr>
<td>M/N-XLPE-SC2_11B</td>
<td>Singer 345 kV</td>
<td>All in Service</td>
<td>3.0 113</td>
</tr>
<tr>
<td>M/N-XLPE-SC2_11C</td>
<td>Singer 345 kV</td>
<td>All Out of Service</td>
<td>3.9 253</td>
</tr>
<tr>
<td>M/N-XLPE-SC2_12B</td>
<td>Devon 345 kV</td>
<td>All in Service</td>
<td>3.0 108</td>
</tr>
<tr>
<td>M/N-XLPE-SC2_12C</td>
<td>Devon 345 kV</td>
<td>All Out of Service</td>
<td>3.9 234</td>
</tr>
<tr>
<td>M/N-XLPE-SC2_13B</td>
<td>Beseeck 345 kV</td>
<td>All in Service</td>
<td>2.9 66</td>
</tr>
<tr>
<td>M/N-XLPE-SC2_13C</td>
<td>Beseeck 345 kV</td>
<td>All Out of Service</td>
<td>3.8 79</td>
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</table>
### Table 4. Resonant Frequencies for M/N-XLPE Project with Local Generators Off
A 500 MVA Synchronous Condenser at East Devon & Singer 345 kV Buses

<table>
<thead>
<tr>
<th>Case</th>
<th>Location</th>
<th>Capacitor Banks</th>
<th>Low</th>
<th>Middle</th>
<th>High</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>HN Z(Ω)</td>
<td>HN Z(Ω)</td>
<td>HN Z(Ω)</td>
</tr>
<tr>
<td>M/N-XLPE2-SC2_1B</td>
<td>Plumtree 345 kV</td>
<td>All in Service</td>
<td>2.7 94</td>
<td>5.7 131</td>
<td>13.6 1427</td>
</tr>
<tr>
<td>M/N-XLPE2-SC2_1C</td>
<td>Plumtree 345 kV</td>
<td>All Out of Service</td>
<td>3.6 161</td>
<td>11.8 296</td>
<td></td>
</tr>
<tr>
<td>M/N-XLPE2-SC2_2B</td>
<td>Plumtree 115 kV</td>
<td>All in Service</td>
<td>2.7 16</td>
<td>6.8 62</td>
<td>9.5 63</td>
</tr>
<tr>
<td>M/N-XLPE2-SC2_2C</td>
<td>Plumtree 115 kV</td>
<td>All Out of Service</td>
<td>3.6 19</td>
<td></td>
<td>11.7 118</td>
</tr>
<tr>
<td>M/N-XLPE2-SC2_3B</td>
<td>Norwalk 345 kV</td>
<td>All in Service</td>
<td>2.7 101</td>
<td>5.7 184</td>
<td></td>
</tr>
<tr>
<td>M/N-XLPE2-SC2_3C</td>
<td>Norwalk 345 kV</td>
<td>All Out of Service</td>
<td>3.7 199</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M/N-XLPE2-SC2_4B</td>
<td>Norwalk 115 kV</td>
<td>All in Service</td>
<td>3.0 14</td>
<td>4.6 16</td>
<td></td>
</tr>
<tr>
<td>M/N-XLPE2-SC2_4C</td>
<td>Norwalk 115 kV</td>
<td>All Out of Service</td>
<td>3.6 16</td>
<td></td>
<td>8.1 23</td>
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<tr>
<td>M/N-XLPE2-SC2_5B</td>
<td>Southington 345 kV</td>
<td>All in Service</td>
<td>2.7 65</td>
<td>4.5 54</td>
<td>8.2 92</td>
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<tr>
<td>M/N-XLPE2-SC2_5C</td>
<td>Southington 345 kV</td>
<td>All Out of Service</td>
<td>3.5 62</td>
<td></td>
<td>10.4 238</td>
</tr>
<tr>
<td>M/N-XLPE2-SC2_6B</td>
<td>Southington 115 kV</td>
<td>All in Service</td>
<td>2.7 11</td>
<td>4.5 21</td>
<td>9.4 119</td>
</tr>
<tr>
<td>M/N-XLPE2-SC2_6C</td>
<td>Southington 115 kV</td>
<td>All Out of Service</td>
<td>3.5 9</td>
<td></td>
<td>10.1 28</td>
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<tr>
<td>M/N-XLPE2-SC2_7B</td>
<td>East Shore 345 kV</td>
<td>All in Service</td>
<td>2.6 73</td>
<td>6.1 247</td>
<td>12.4 267</td>
</tr>
<tr>
<td>M/N-XLPE2-SC2_7C</td>
<td>East Shore 345 kV</td>
<td>All Out of Service</td>
<td>3.5 76</td>
<td></td>
<td>10.1 274</td>
</tr>
<tr>
<td>M/N-XLPE2-SC2_8B</td>
<td>Devon 115 kV</td>
<td>All in Service</td>
<td>2.7 12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M/N-XLPE2-SC2_8C</td>
<td>Devon 115 kV</td>
<td>All Out of Service</td>
<td>3.5 14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M/N-XLPE2-SC2_9B</td>
<td>Frost Bridge 115 kV</td>
<td>All in Service</td>
<td>2.7 16</td>
<td>4.5 21</td>
<td>8.3 35</td>
</tr>
<tr>
<td>M/N-XLPE2-SC2_9C</td>
<td>Frost Bridge 115 kV</td>
<td>All Out of Service</td>
<td>3.5 11</td>
<td></td>
<td>10.1 26</td>
</tr>
<tr>
<td>M/N-XLPE2-SC2_10B</td>
<td>Glenbrook 115 kV</td>
<td>All in Service</td>
<td>2.7 15</td>
<td>4.5 29</td>
<td></td>
</tr>
<tr>
<td>M/N-XLPE2-SC2_10C</td>
<td>Glenbrook 115 kV</td>
<td>All Out of Service</td>
<td>3.6 16</td>
<td>8.1 41</td>
<td>16.1 53</td>
</tr>
<tr>
<td>M/N-XLPE2-SC2_11B</td>
<td>Singer 345 kV</td>
<td>All in Service</td>
<td>2.7 94</td>
<td>5.7 187</td>
<td>13.6 385</td>
</tr>
<tr>
<td>M/N-XLPE2-SC2_11C</td>
<td>Singer 345 kV</td>
<td>All Out of Service</td>
<td>3.7 188</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M/N-XLPE2-SC2_12B</td>
<td>Devon 345 kV</td>
<td>All in Service</td>
<td>2.7 90</td>
<td>5.7 168</td>
<td>13.6 498</td>
</tr>
<tr>
<td>M/N-XLPE2-SC2_12C</td>
<td>Devon 345 kV</td>
<td>All Out of Service</td>
<td>3.7 175</td>
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<tr>
<td>M/N-XLPE2-SC2_13B</td>
<td>Besec 345 kV</td>
<td>All in Service</td>
<td>2.6 56</td>
<td></td>
<td>12.4 297</td>
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<tr>
<td>M/N-XLPE2-SC2_13C</td>
<td>Besec 345 kV</td>
<td>All Out of Service</td>
<td>3.6 66</td>
<td></td>
<td>10.4 239</td>
</tr>
</tbody>
</table>
Conclusions

Table 5 summarizes the variation in frequencies of the first resonance points for the M/N project, for the XLPE alternative, for Synchronous Condenser Option 1, and for Synchronous Condenser Option 2, with the original light load generator dispatch. Table 6 summarizes the variation in frequencies of the first resonance points in the light post-project dispatch with more local generation off. With Synchronous Condenser Option 2 and with the original light load generator dispatch, the first resonance is between 3.0 and 3.9 pu of 60 Hz at most 345 kV buses, with all capacitor banks in and out of service, respectively. With Synchronous Condenser Option 2 and with more local generation off, the first resonance is between 2.7 and 3.6 pu of 60 Hz at most 345 kV buses, with all capacitor banks in and out of service, respectively.

Table 5. Variation in Frequency of First Resonance Points (pu 60 Hz) with Original Light Load Generator Dispatch

<table>
<thead>
<tr>
<th>115 kV Capacitor Bank Conditions</th>
<th>M/N Project with HPFF Cable</th>
<th>M/N Project with XLPE Cable</th>
<th>Synchronous Condenser Option 1 (Case 5c)</th>
<th>Synchronous Condenser Option 2 (Case 5d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All in service</td>
<td>2.4</td>
<td>2.8</td>
<td>2.9</td>
<td>3.0</td>
</tr>
<tr>
<td>All out of service</td>
<td>2.8</td>
<td>3.5</td>
<td>3.7</td>
<td>3.9</td>
</tr>
</tbody>
</table>

Table 6. Variation in Frequency of First Resonance Points (pu 60 Hz) in Light Post-Project Dispatch with More Local Generators Off

<table>
<thead>
<tr>
<th>115 kV Capacitor Bank Conditions</th>
<th>M/N Project with HPFF Cable</th>
<th>M/N Project with XLPE Cable</th>
<th>Synchronous Condenser Option 1 (Case 5c)</th>
<th>Synchronous Condenser Option 2 (Case 5d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All in service</td>
<td>-</td>
<td>2.5</td>
<td>2.6</td>
<td>2.7</td>
</tr>
<tr>
<td>All out of service</td>
<td>-</td>
<td>3.3</td>
<td>3.5</td>
<td>3.6</td>
</tr>
</tbody>
</table>

The addition of a second 500 MVA synchronous condenser at Singer results in a slightly higher frequency of the first resonance, as compared to the single synchronous condenser at East Devon. Since the short-circuit contribution at 345 kV of a 500 MVA synchronous
condenser, with assumed impedances including GSU, is relatively small (about 2.4 kA) compared with the existing short-circuit levels, it has a relatively small impact on the resonant frequency. With the original light load generator dispatch and all capacitor banks in service, the frequency is 3.0 pu of 60 Hz. Risk of sustained overvoltages due to transformer inrush is increased when resonances are near 3rd harmonic or below. System outages are another important consideration, since a variety of outages would similarly cause variation in resonant frequencies, because of the effect of changing either the strength of the system or the effective charging capacitance in the system. Consideration of minimum generator dispatches and system outages (such as an outage of the line from East Devon to Beseck) which would weaken the system together with the maximum allowable 115 kV capacitor bank dispatches and 345 kV cable charging capacitance would result in the lowest frequencies of the first resonance. If all first resonances were located above 3rd harmonic, under such a range of variations, the risk of sustained overvoltages due to transformer inrush would be reduced. However, if varying system conditions result in resonances below 3rd harmonic, then extensive transient studies should be performed to investigate transformer inrush scenarios, under a range of system conditions. Fault and clear scenarios are particularly critical since special circuit breaker closing enhancements have no effect. If the Synchronous Condenser Option 2 (Case 5d) studied here is to be considered, then extensive transient studies would be recommended.
Appendix A  Driving-Point Impedance Plots with Light Load Generation

M/N-XLPE Project. Synchronous Condenser at East Devon & Singer. Impedance at Plumtree 345 kV Bus

Case M/N-XLPE-SC2_1B, All Capacitor Banks in Service
Case M/N-XLPE-SC2_1C, All Capacitor Banks Out of Service

M/N-XLPE Project. Synchronous Condenser at East Devon & Singer. Impedance at Plumtree 115 kV Bus

Case M/N-XLPE-SC2_2B, All Capacitor Banks in Service
Case M/N-XLPE-SC2_2C, All Capacitor Banks Out of Service

M/N-XLPE Project. Synchronous Condenser at East Devon & Singer. Impedance at Norwalk 345 kV Bus

Case M/N-XLPE-SC2_3B, All Capacitor Banks in Service
Case M/N-XLPE-SC2_3C, All Capacitor Banks Out of Service
M/N-XLPE Project. Synchronous Condenser at East Devon & Singer. Impedance at Norwalk 115 kV Bus

- Case M/N-XLPE-SC2_4B, All Capacitor Banks in Service
- Case M/N-XLPE-SC2_4C, All Capacitor Banks Out of Service

M/N-XLPE Project. Synchronous Condenser at East Devon & Singer. Impedance at Southington 345 kV Bus

- Case M/N-XLPE-SC2_5B, All Capacitor Banks in Service
- Case M/N-XLPE-SC2_5C, All Capacitor Banks Out of Service

M/N-XLPE Project. Synchronous Condenser at East Devon & Singer. Impedance at Southington 115 kV Bus

- Case M/N-XLPE-SC2_6B, All Capacitor Banks in Service
- Case M/N-XLPE-SC2_6C, All Capacitor Banks Out of Service
Case M/N-XLPE-SC2_7B, All Capacitor Banks in Service
Case M/N-XLPE-SC2_7C, All Capacitor Banks Out of Service

Case M/N-XLPE-SC2_8B, All Capacitor Banks in Service
Case M/N-XLPE-SC2_8C, All Capacitor Banks Out of Service

Case M/N-XLPE-SC2_9B, All Capacitor Banks in Service
Case M/N-XLPE-SC2_9C, All Capacitor Banks Out of Service
Case M/N-XLPE-SC2_13B, All Capacitor Banks in Service
Case M/N-XLPE-SC2_13C, All Capacitor Banks Out of Service
Appendix B  Driving-Point Impedance Plots with Local Generators Off

M/N-XLPE Project. Local Generators Off. Synch Condenser at East Devon & Singer. Impedance at Plumtree 345 kV Bus

0 100 200 300 400 500 600 700 800 900 1000

<table>
<thead>
<tr>
<th>Frequency (Hz)</th>
<th>Impedance (ohm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>50</td>
</tr>
<tr>
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<td>100</td>
</tr>
<tr>
<td>200</td>
<td>150</td>
</tr>
<tr>
<td>300</td>
<td>200</td>
</tr>
</tbody>
</table>

Case M/N-XLPE2-SC2_1B, All Capacitor Banks in Service
Case M/N-XLPE2-SC2_1C, All Capacitor Banks Out of Service

M/N-XLPE Project. Local Generators Off. Synch Condenser at East Devon & Singer. Impedance at Plumtree 115 kV Bus

0 100 200 300 400 500 600 700 800 900 1000

<table>
<thead>
<tr>
<th>Frequency (Hz)</th>
<th>Impedance (ohm)</th>
</tr>
</thead>
<tbody>
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<td>0</td>
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<tr>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>200</td>
<td>150</td>
</tr>
<tr>
<td>300</td>
<td>200</td>
</tr>
</tbody>
</table>

Case M/N-XLPE2-SC2_2B, All Capacitor Banks in Service
Case M/N-XLPE2-SC2_2C, All Capacitor Banks Out of Service

M/N-XLPE Project. Local Generators Off. Synch Condenser at East Devon & Singer. Impedance at Norwalk 345 kV Bus

0 100 200 300 400 500 600 700 800 900 1000

<table>
<thead>
<tr>
<th>Frequency (Hz)</th>
<th>Impedance (ohm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>50</td>
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<td>200</td>
<td>150</td>
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<tr>
<td>300</td>
<td>200</td>
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Case M/N-XLPE2-SC2_3B, All Capacitor Banks in Service
Case M/N-XLPE2-SC2_3C, All Capacitor Banks Out of Service
M/N-XLPE Project. Local Generators Off. Synch Condenser at East Devon & Singer. Impedance at Norwalk 115 kV Bus

*Case M/N-XLPE2-SC2_4B, All Capacitor Banks in Service*
*Case M/N-XLPE2-SC2_4C, All Capacitor Banks Out of Service*

M/N-XLPE Project. Local Generators Off. Synch Condenser at East Devon & Singer. Impedance at Southington 345 kV Bus

*Case M/N-XLPE2-SC2_5B, All Capacitor Banks in Service*
*Case M/N-XLPE2-SC2_5C, All Capacitor Banks Out of Service*

M/N-XLPE Project. Local Generators Off. Synch Condenser at East Devon & Singer. Impedance at Southington 115 kV Bus

*Case M/N-XLPE2-SC2_6B, All Capacitor Banks in Service*
*Case M/N-XLPE2-SC2_6C, All Capacitor Banks Out of Service*
M/N-XLPE Project. Local Generators Off. Synch Condenser at East Devon & Singer. Impedance at East Shore 345 kV Bus

M/N-XLPE Project. Local Generators Off. Synch Condenser at East Devon & Singer. Impedance at Devon 115 kV Bus

M/N-XLPE Project. Local Generators Off. Synch Condenser at East Devon & Singer. Impedance at Frost Bridge 115 kV Bus
M/N-XLPE Project. Local Generators Off. Synch Condenser at East Devon & Singer. Impedance at Glenbrook 115 kV Bus

- Case M/N-XLPE2-SC2_10B, All Capacitor Banks in Service
- Case M/N-XLPE2-SC2_10C, All Capacitor Banks Out of Service

M/N-XLPE Project. Local Generators Off. Synch Condenser at East Devon & Singer. Impedance at Singer 345 kV Bus

- Case M/N-XLPE2-SC2_11B, All Capacitor Banks in Service
- Case M/N-XLPE2-SC2_11C, All Capacitor Banks Out of Service

M/N-XLPE Project. Local Generators Off. Synch Condenser at East Devon & Singer. Impedance at Devon 345 kV Bus

- Case M/N-XLPE2-SC2_12B, All Capacitor Banks in Service
- Case M/N-XLPE2-SC2_12C, All Capacitor Banks Out of Service