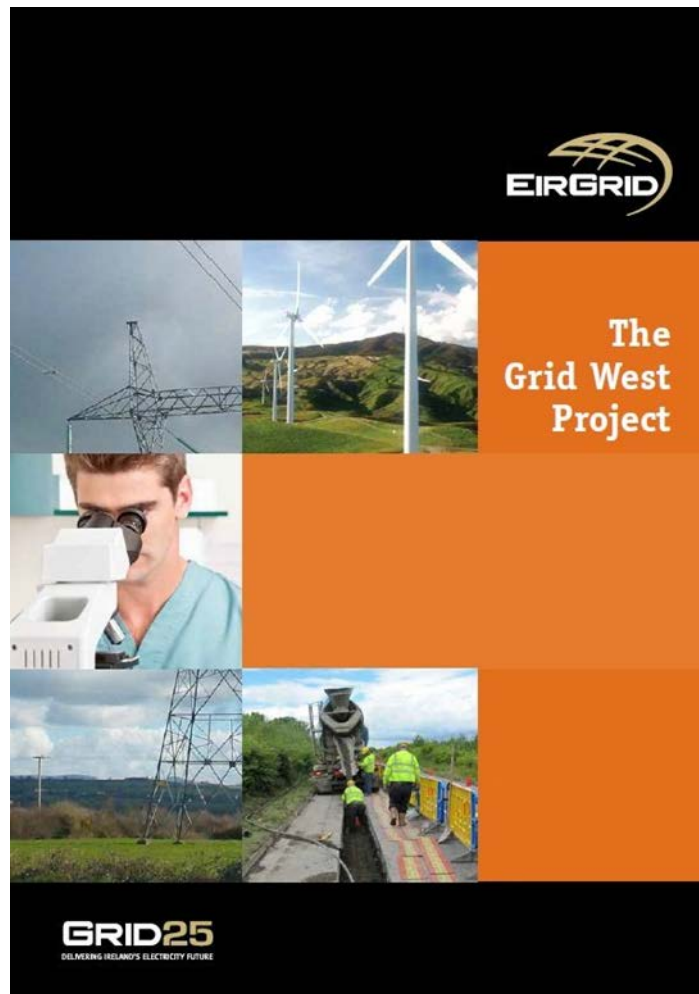


EirGrid

10344 - PSP019 - CABLE STUDIES FOR GRID WEST

Partial AC Underground Solution



**APPENDIX E – EVALUATING VARIOUS LENGTHS –
SUMMER VALLEY B**

17th December 2014

REPORT AUTHORISATION SHEET

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Project: **10344 - PSP019 - Cable Studies for Grid west**
Report Title **Summer Valley B Summer Valley B**
Project Number **10344**
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Version No.	Report Date	Comment	Author	Checked	Authorised
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1 RESULTS

Impedance scans and time domain simulations for a 220kV cable with sized reactors at both Flagford and North Mayo. This appendix includes the results for a range of cable / OHL combinations for the Summer Valley B generation / demand scenario. It will cover a number of cable options studied; however, the cases have failed due to a variety of issues relating to high resonance points below the 3rd harmonic of above 1000 Ohms and TOVs exceeding the allowable limits.¹

1.1 Impedance Scans - 80 km cable / 30 km OHL– Summer Valley B – Case 1

Conditions for impedance scan:

1. Summer Valley B network
2. Length - 80 km 220kV Cable/30km Overhead Line
3. Reactors – North Mayo 225MVar/Flagford 150Mvar

¹ For the purposes of clarity, in the Time Domain Simulations shown in all the Appendices, the term ‘N-2’ shown in the graphical figure descriptions refer to an ‘N-1-1’ trip-maintenance situation.

Case 1: (N-2) Cashla-Flagford/Flagford-Louth Lines Out

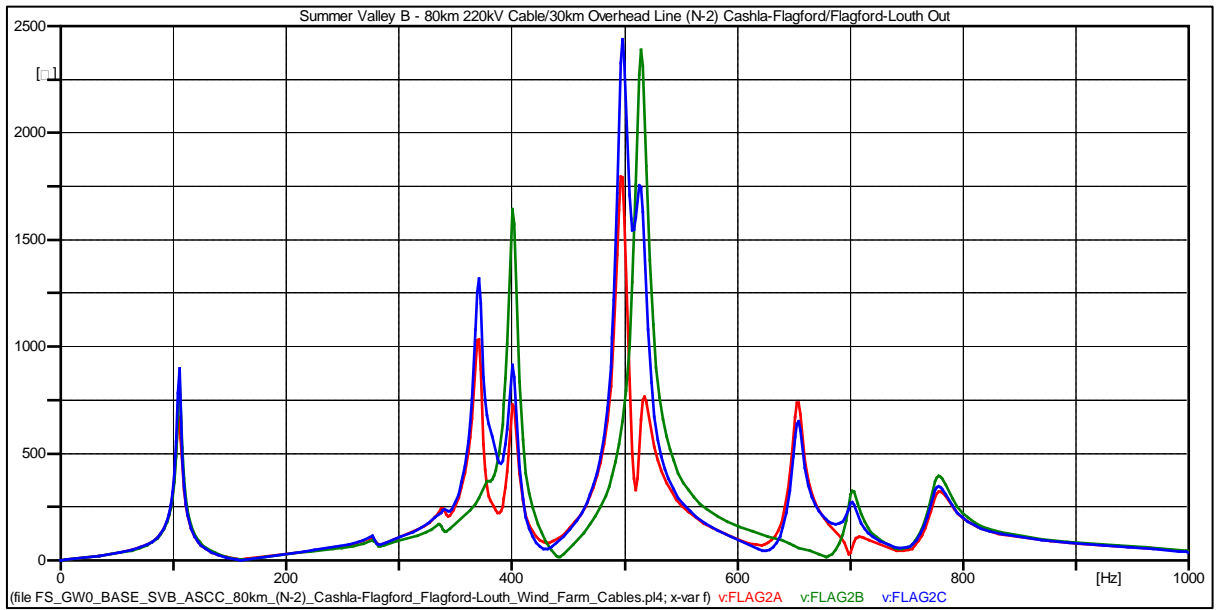


Figure 1: SVB - Length 80 km cable / 30 km OHL - (N-2) Cashla-Flagford/Flagford-Louth Lines Out

Impedance Scan - Resonance points

Frequency (Hz)	Impedance (Ω)
105.51	739.67
370.51	1317.0
400.51	1641.4
499.51	2327.5
514.51	2390.4
654.01	737.85
778.51	395.3

1.2 Time Domain Simulation - Length 80 km cable / 30 km OHL – Summer Valley B – Case 1

Conditions for time domain simulation:

1. Summer Valley B network
2. Length 80 km cable / 30 km OHL

Case 1: (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out

System Conditions:

1. Fault on Flagford side of Flagford-Cashla line, applied at 0.5s.
2. Reclose sequence at 0.575s, dead time 0.6s, circuit breaker closes 1.175s, point on wave closes at 90°.
3. Breaker opens at again at 1.25s.

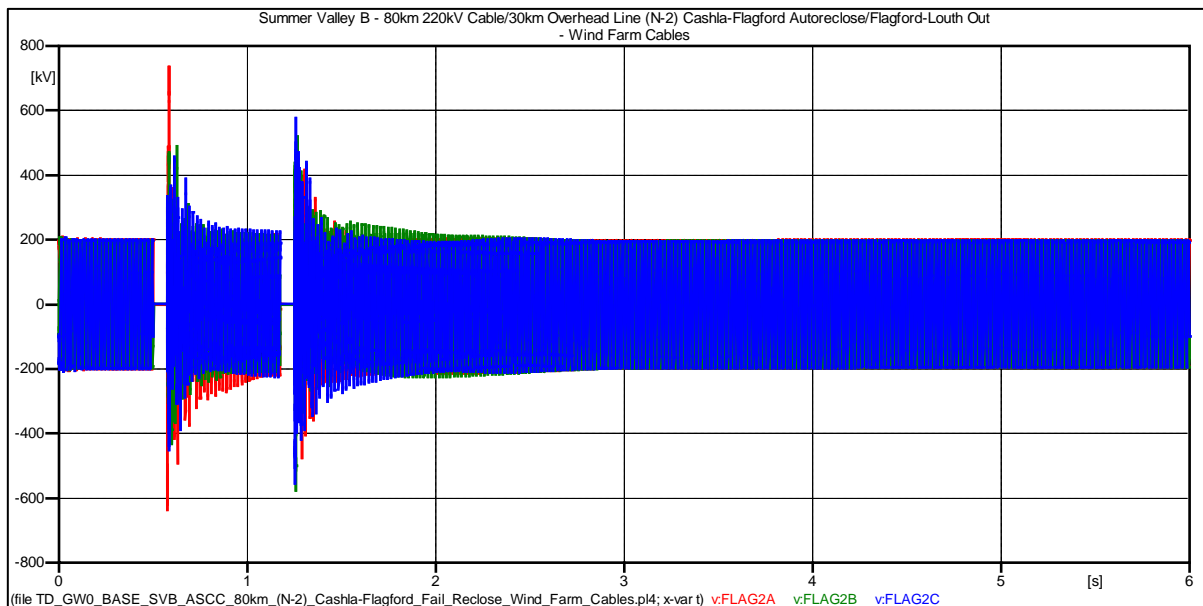


Figure 2: SVB - Length 80km cable / 30 km OHL - Flagford – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-6s)

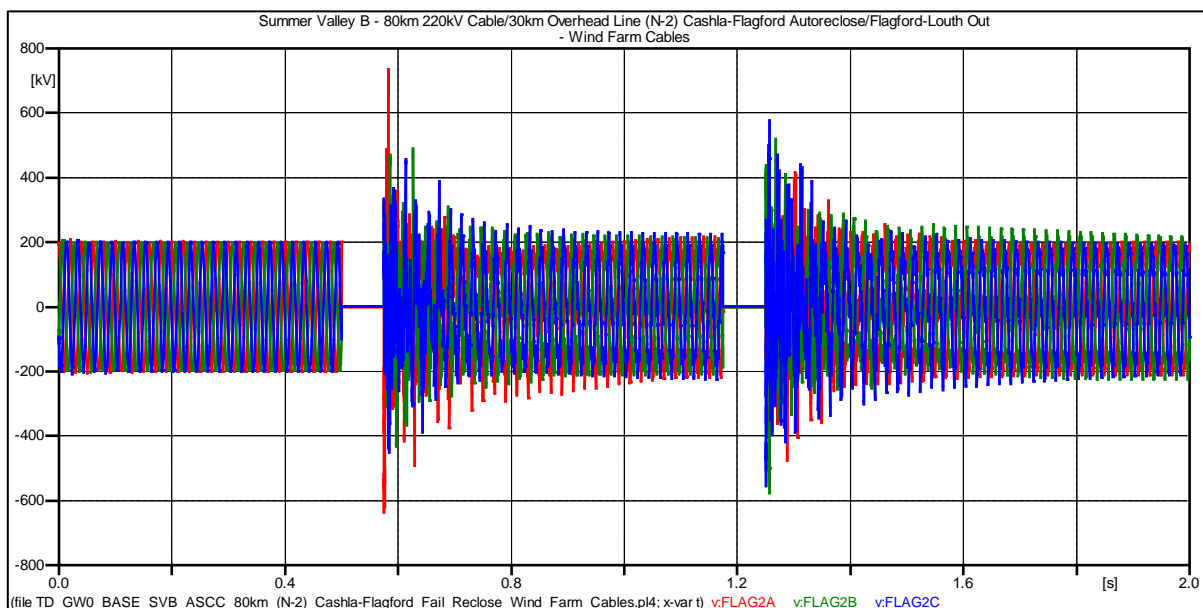


Figure 3: SVB - Length 80 km cable / 30 km OHL - Flagford – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-2s)

Condition	Maximum Value	Limit	Result
Switching	753.2 kV (4.218 pu)	449.073 kV (2.5pu)	Fail
Temporary Overvoltage	496.23 kV (2.7632 pu)	287.32 kV (1.6 pu)	Fail

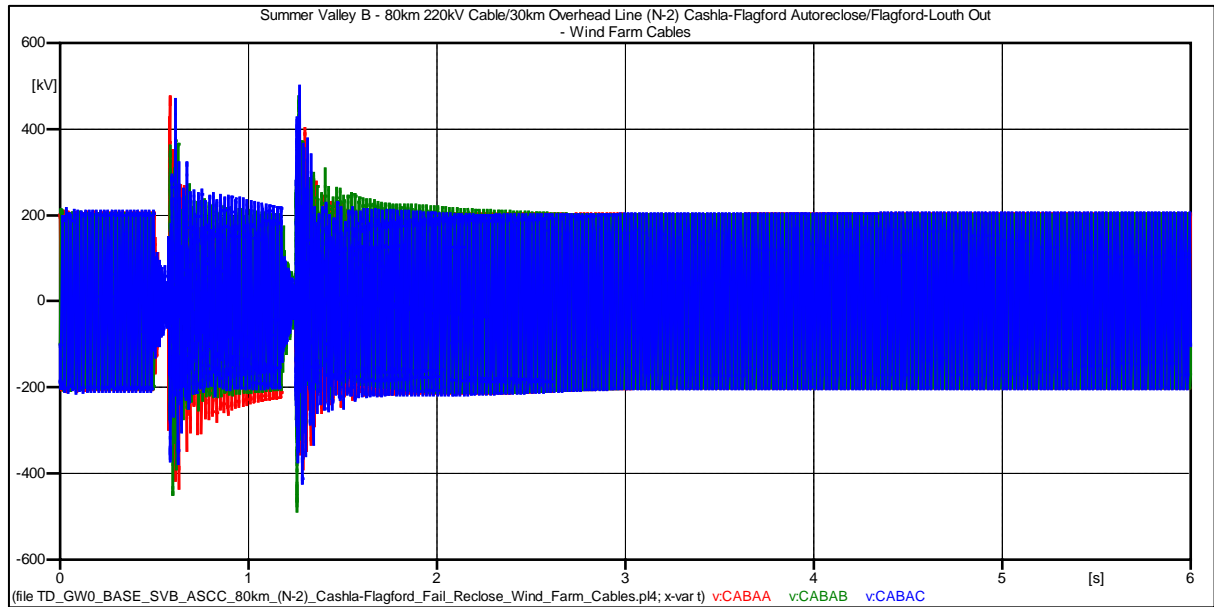


Figure 4: SVB - Length 80 km cable / 30 km OHL – Cable End A – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-6s)

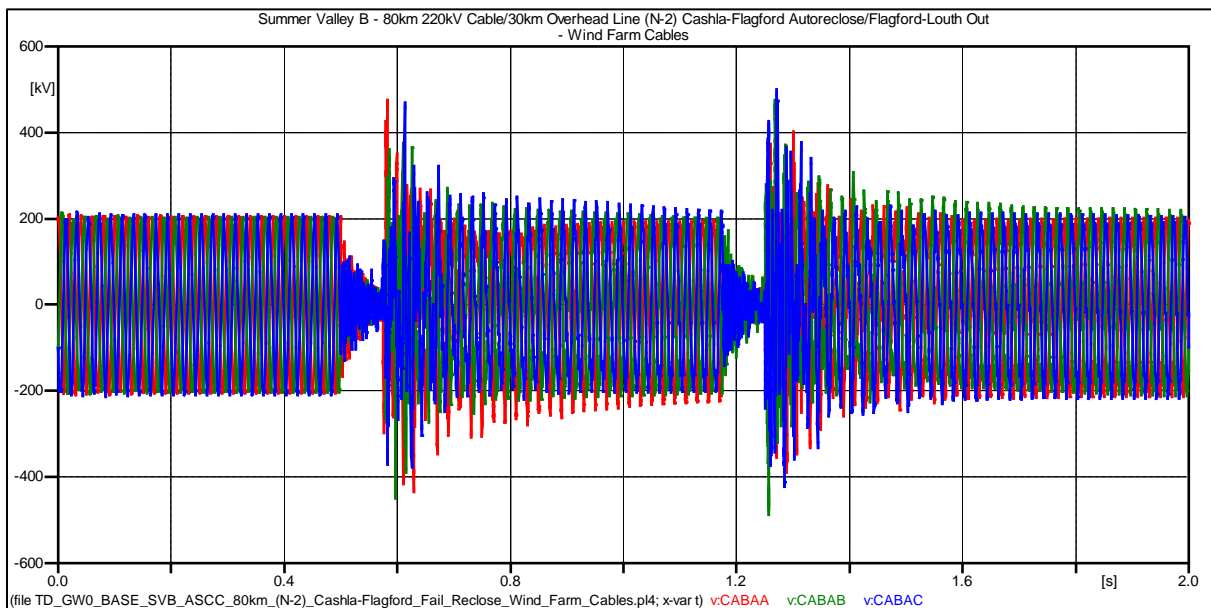


Figure 5: SVB - Length 80 km cable / 30 km OHL – Cable End A – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-2s)

Condition	Maximum Value	Limit	Result
Switching	480.5 kV (2.6910 pu)	449.073 kV (2.5pu)	Fail
Temporary Overvoltage	350.12 kV (1.949 pu)	287.32 kV (1.6 pu)	Fail

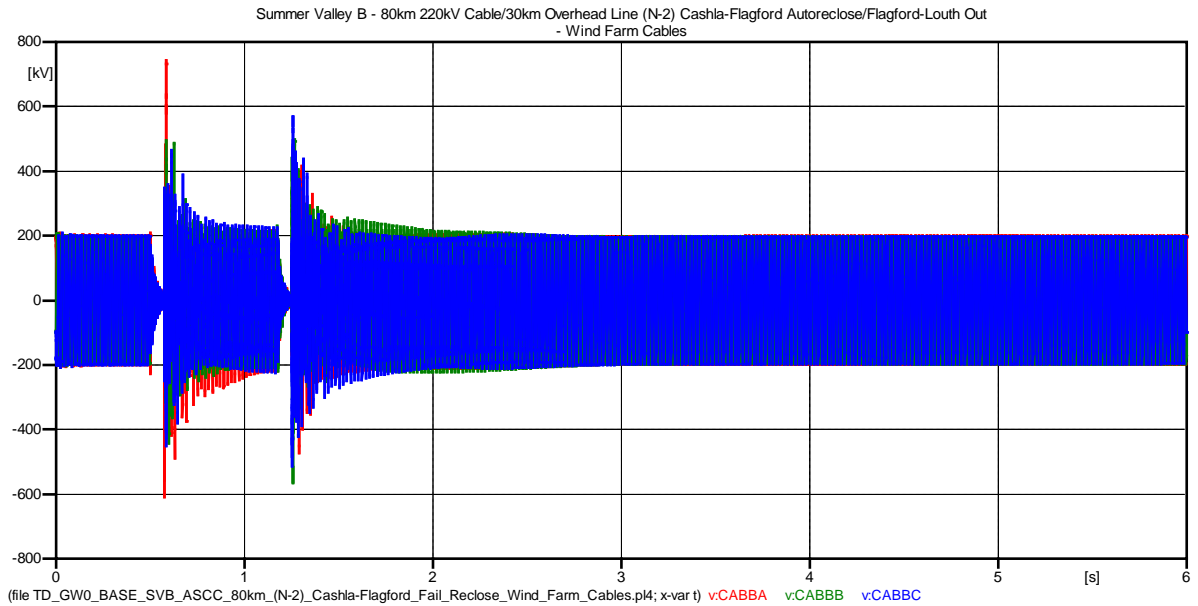


Figure 6: SVB - Length 80 km cable / 30 km OHL – Cable End B – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-6s)

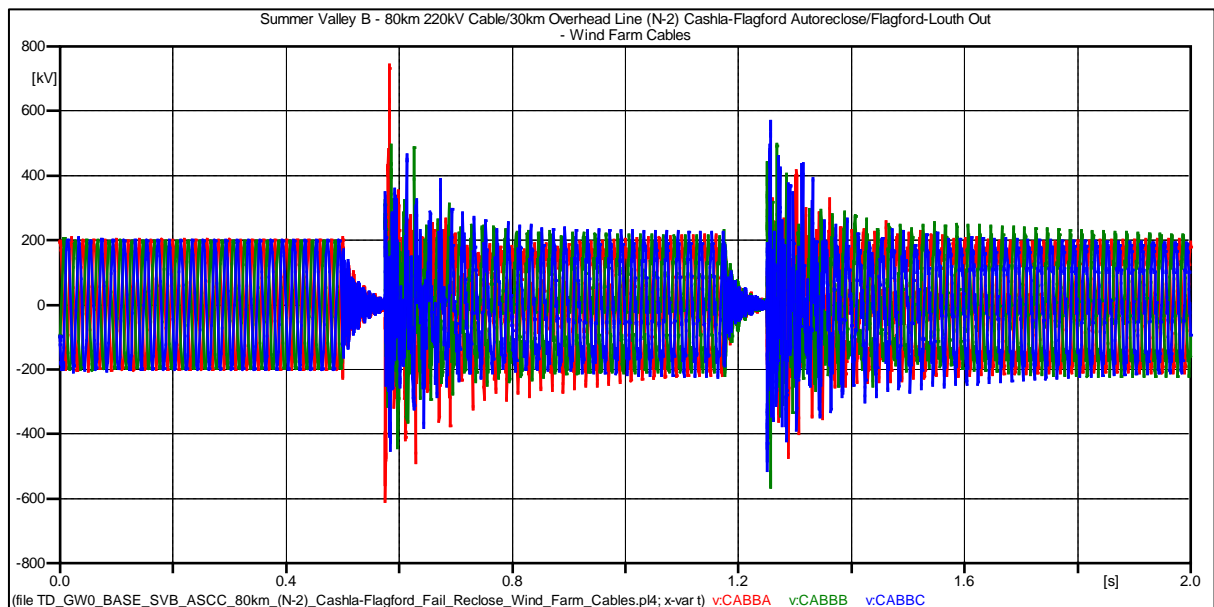


Figure 7: SVB - Length 80 km cable / 30 km OHL – Cable End B – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-2s)

Condition	Maximum Value	Limit	Result
Switching	770.10 kV (4.3130 pu)	449.073 kV (2.5pu)	Fail
Temporary Overvoltage	470.12 kV (2.617 pu)	287.32 kV (1.6 pu)	Fail

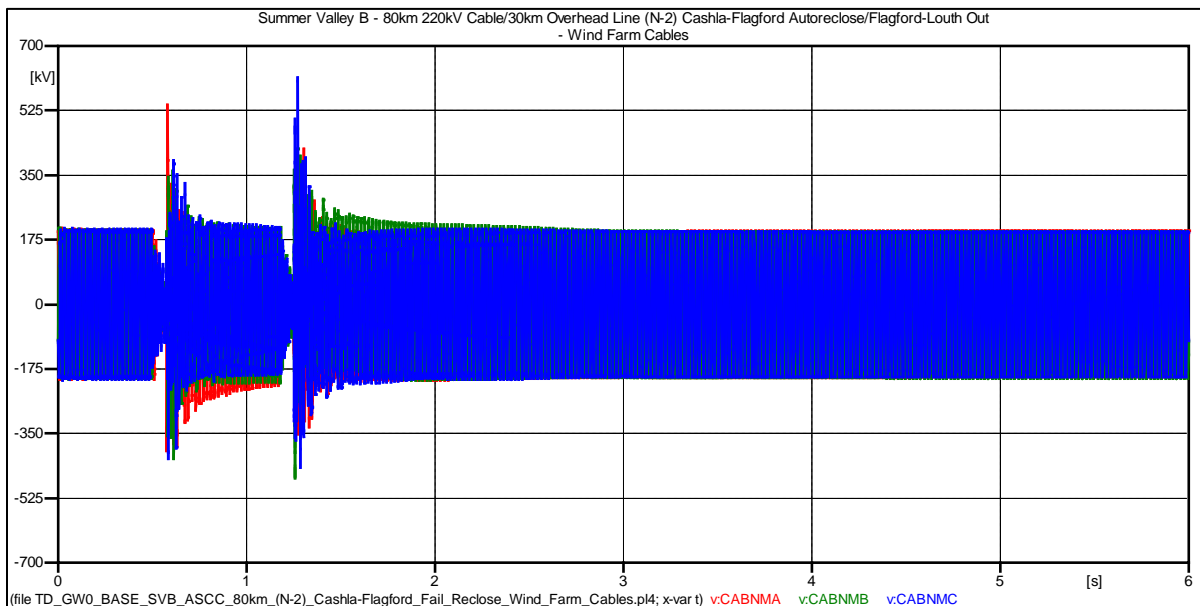


Figure 8: SVB - Length 80 km cable / 30 km OHL – Cable End - North Mayo – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-6s)

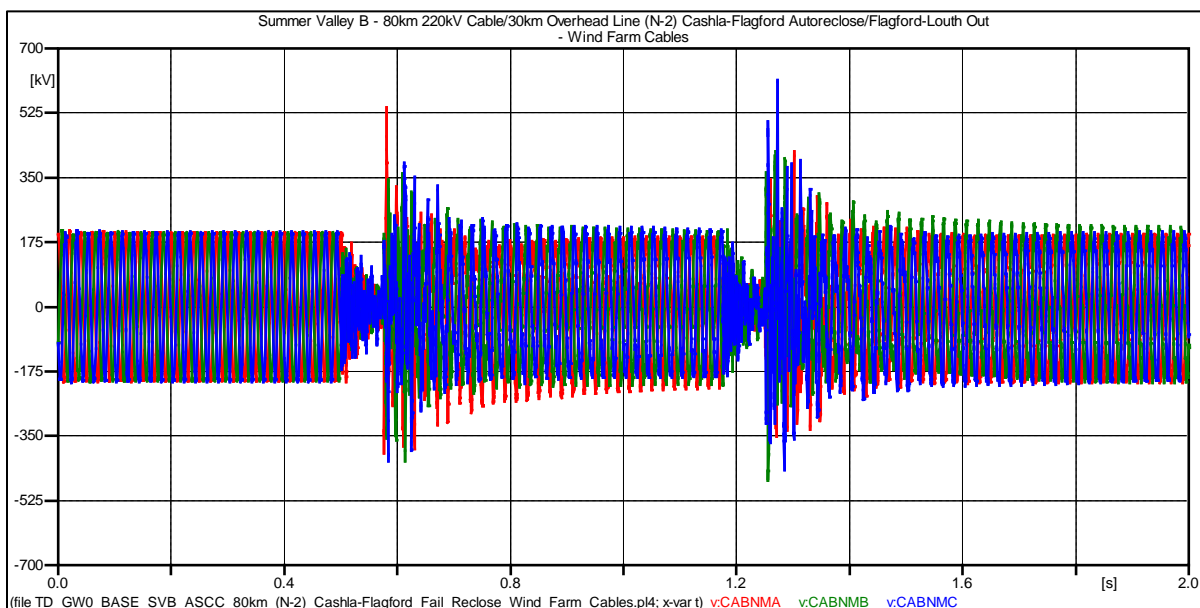


Figure 9: SVB - Length 80 km cable / 30 km OHL – Cable End - North Mayo – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-6s)

Condition	Maximum Value	Limit	Result
Switching	531.28 kV (2.958 pu)	449.073 kV (2.5pu)	Fail
Temporary Overvoltage	423.56 kV (2.358 pu)	287.32 kV (1.6 pu)	Fail

1.3 Impedance Scans - Length 70 km cable / 40 km OHL– Summer Valley B – Case 2

Conditions for impedance scan:

1. Summer Valley B network
2. Length - 70 km 220kV Cable/40km Overhead Line
3. Reactors – North Mayo 200MVar/Flagford 125MVar

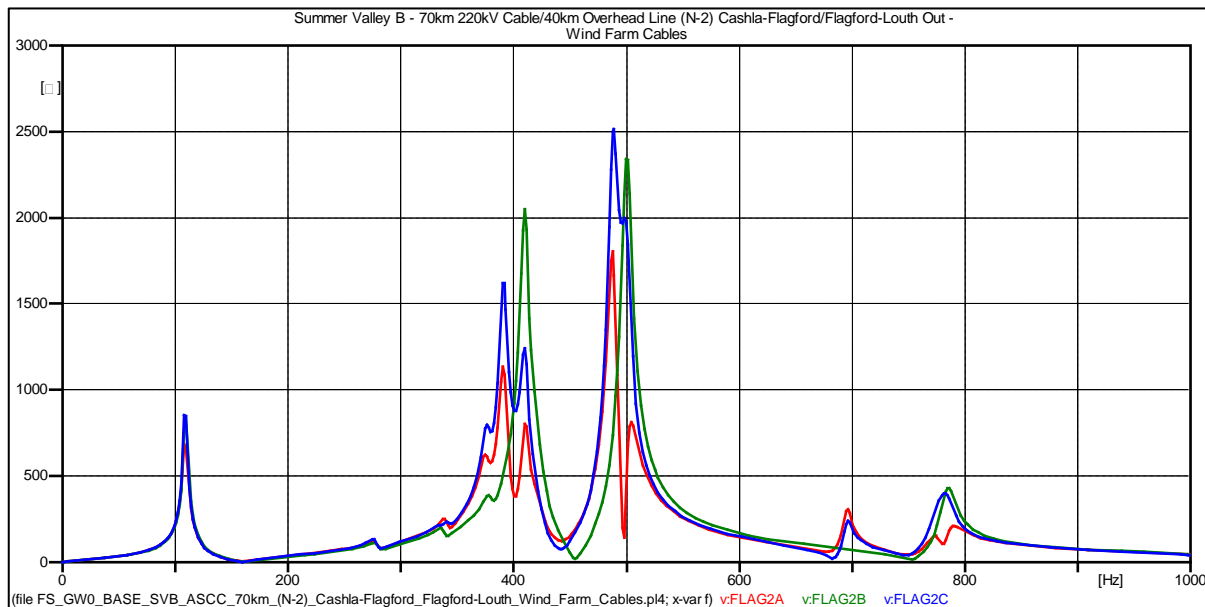


Figure 10: SVB - Length 70 km cable / 40 km OHL - (N-2) Cashla-Flagford/Flagford-Louth Lines Out

Impedance Scan - Resonance points

Frequency (Hz)	Impedance (Ω)
109.51	847.09
391.51	1620.1
411.01	1933.3
489.01	2514.4
501.01	2337.9

1.4 Time Domain Simulation - Length 70km cable / 40 km OHL – Summer Valley B – Case 2

Conditions for time domain simulation:

1. Summer Valley B network
2. Length 70 km 220 kV cable / 40 km OHL

Case 2: (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out

System Conditions:

1. Fault on Flagford side of Flagford-Cashla line, applied at 0.5s.
2. Reclose sequence at 0.575s, dead time 0.6s, circuit breaker closes 1.175s, point on wave closes at 90°.
3. Breaker opens at again at 1.25s.

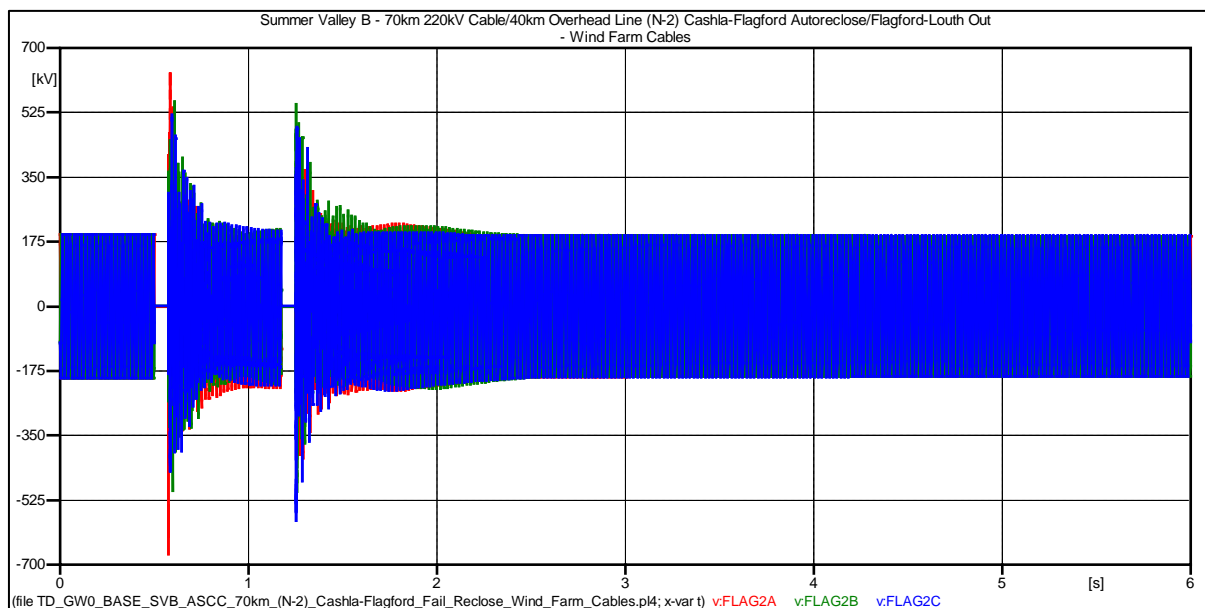


Figure 11: SVB - Length 70 km cable / 40 km OHL – Flagford – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-6s)

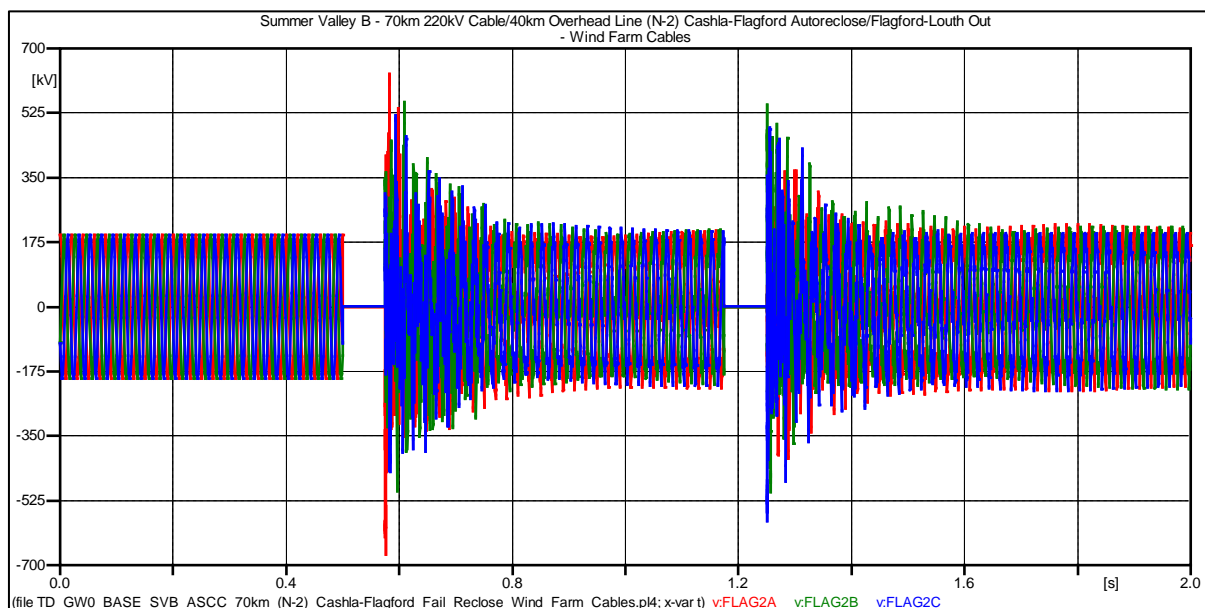


Figure 12: SVB - Length 70 km cable / 40 km OHL – Flagford – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-2s)

Condition	Maximum Value	Limit	Result
Switching	642.12 kV (3.5961 pu)	449.073 kV (2.5pu)	Fail
Temporary Overvoltage	380.12 kV (2.128 pu)	287.32 kV (1.6 pu)	Fail

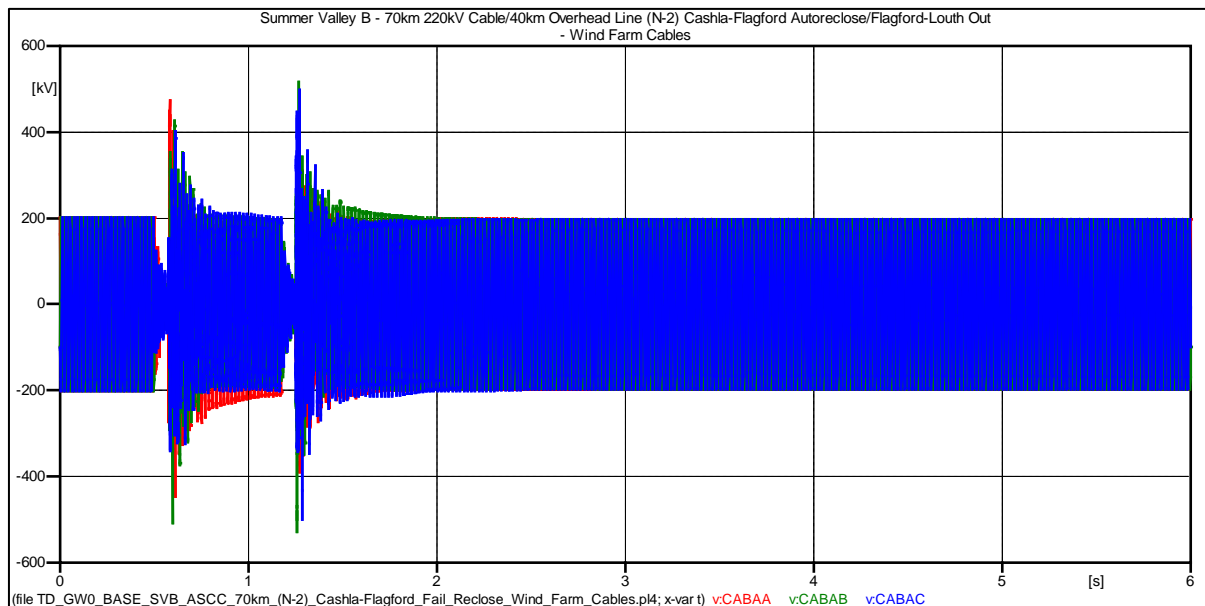


Figure 13: SVB - Length 70 km cable / 40 km OHL – Cable End A – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-6s)

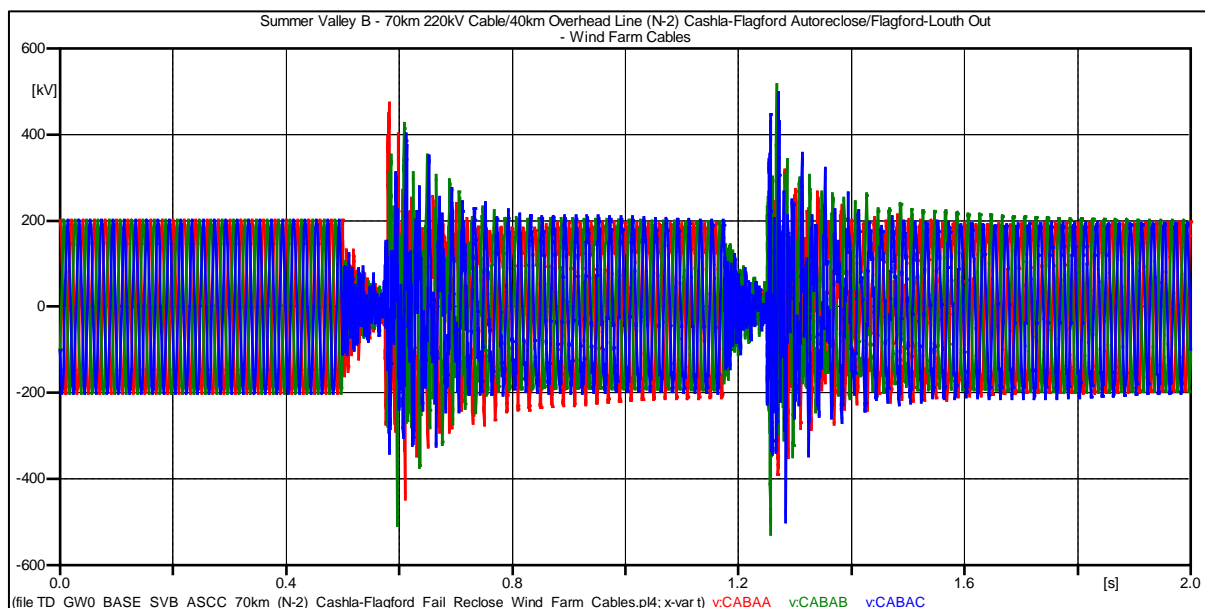


Figure 14: SVB - Length 70 km cable / 40 km OHL – Cable End A – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-2s)

Condition	Maximum Value	Limit	Result
Switching	642.12 kV (3.5961 pu)	449.073 kV (2.5pu)	Fail
Temporary Overvoltage	380.12 kV (2.128 pu)	287.32 kV (1.6 pu)	Fail

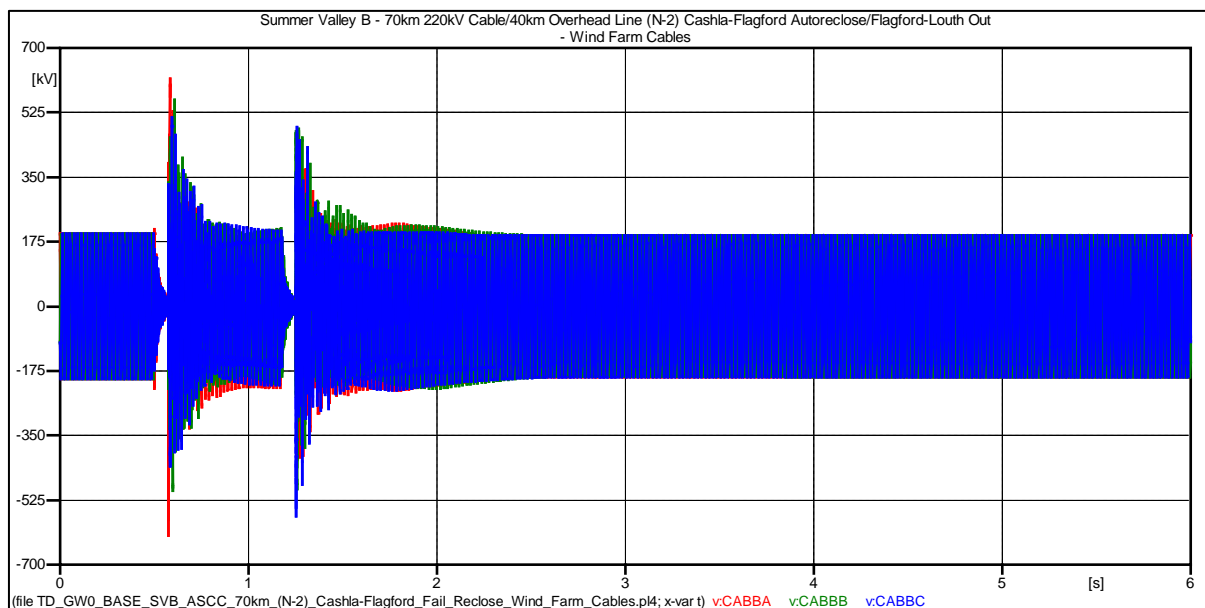


Figure 15: SVB - Length 70 km cable / 40 km OHL – Cable End B – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-6s)

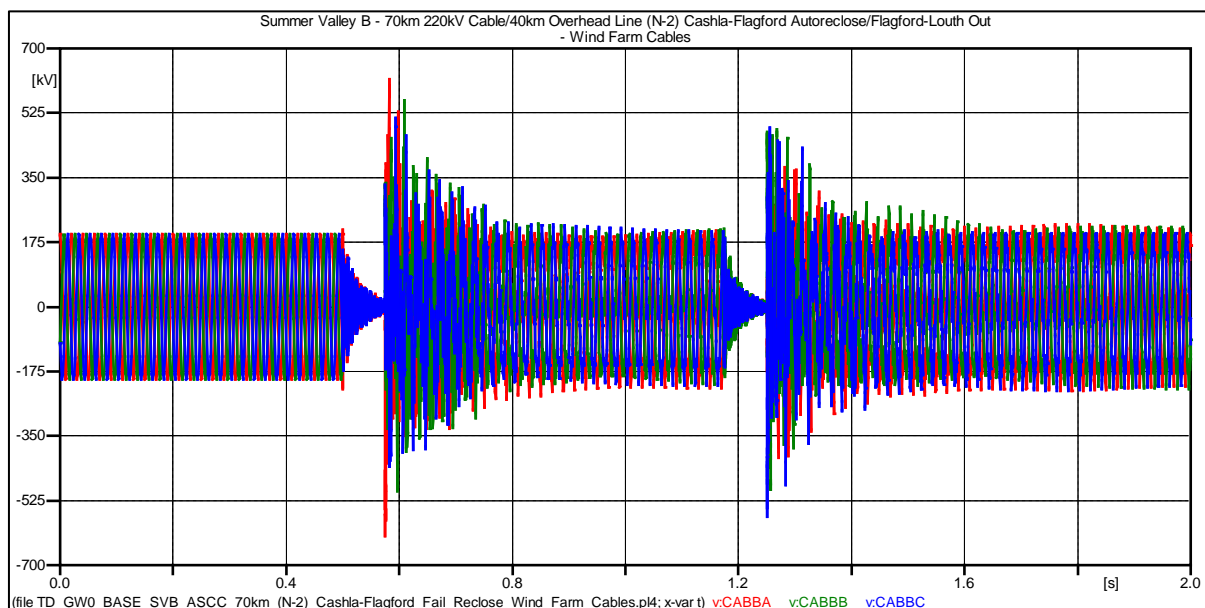


Figure 16: SVB - Length 70 km cable / 40 km OHL – Cable End B – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-2s)

Condition	Maximum Value	Limit	Result
Switching	642.12 kV (3.5961 pu)	449.073 kV (2.5pu)	Fail
Temporary Overvoltage	380.12 kV (2.128 pu)	287.32 kV (1.6 pu)	Fail

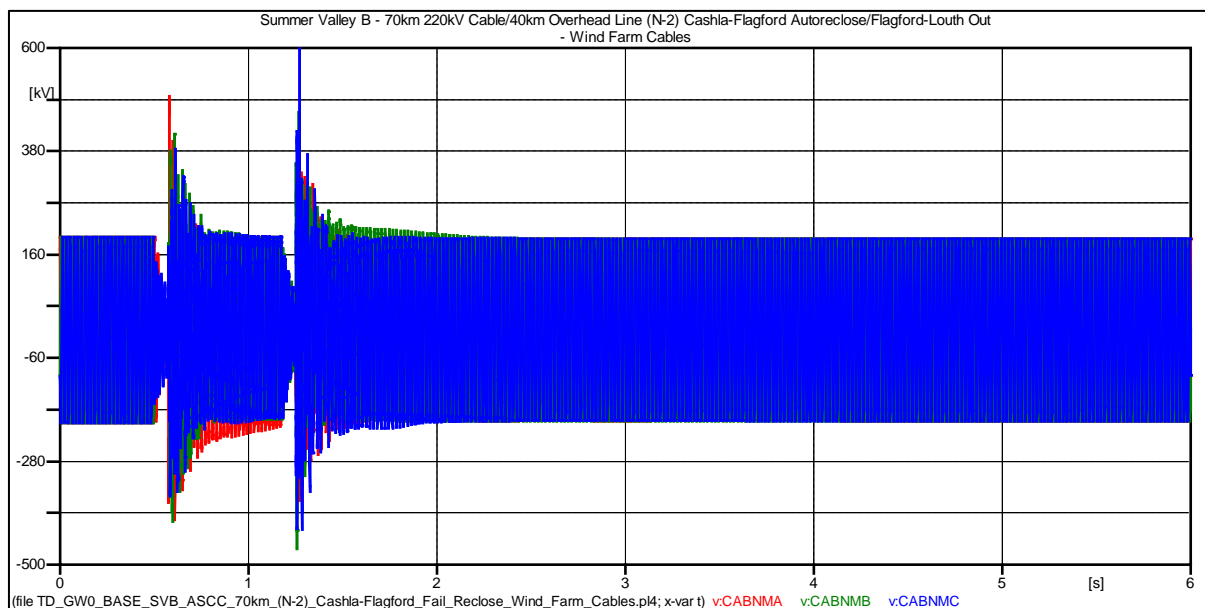


Figure 17: SVB - Length 70 km cable / 40 km OHL – Cable End - North Mayo – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-6s)

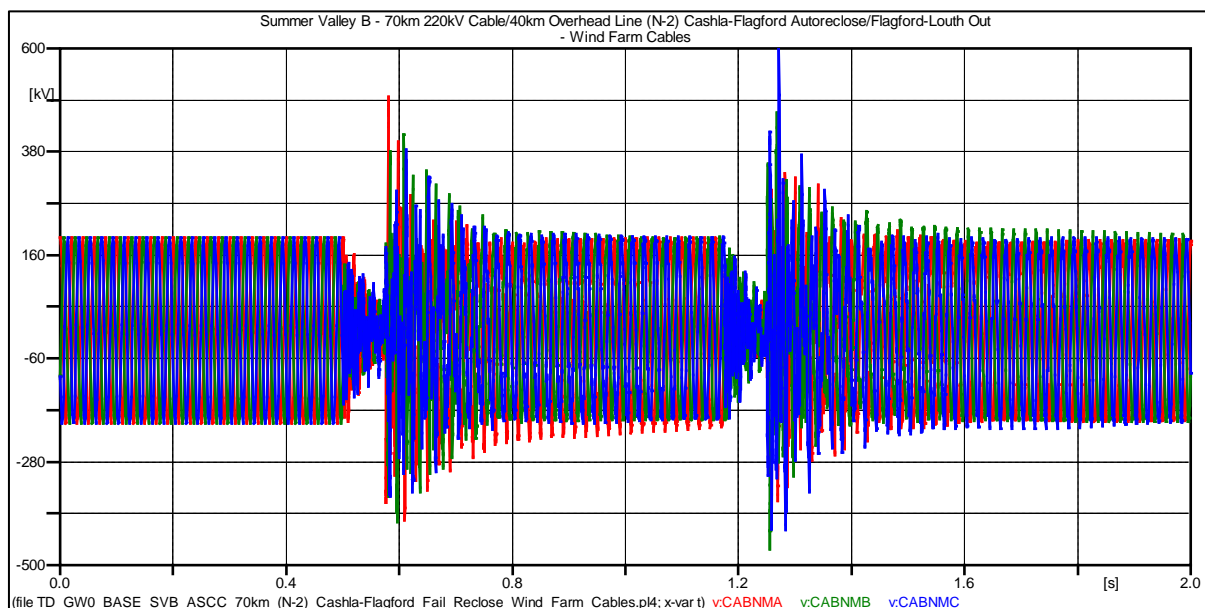


Figure 18: SVB - Length 70 km cable / 40 km OHL – Cable End - North Mayo – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-2s)

Condition	Maximum Value	Limit	Result
Switching	601.12 kV (3.3665 pu)	449.073 kV (2.5pu)	Fail
Temporary Overvoltage	330.12 kV (1.844 pu)	287.32 kV (1.6 pu)	Fail

1.5 Impedance Scans - Length 40 km cable / 70 km OHL – Summer Valley B – Case 3

Conditions for impedance scan:

1. Summer Valley B network
2. Length - 40 km 220kV Cable/70km Overhead Line
3. Reactors – North Mayo 100MVar/Flagford 75MVar

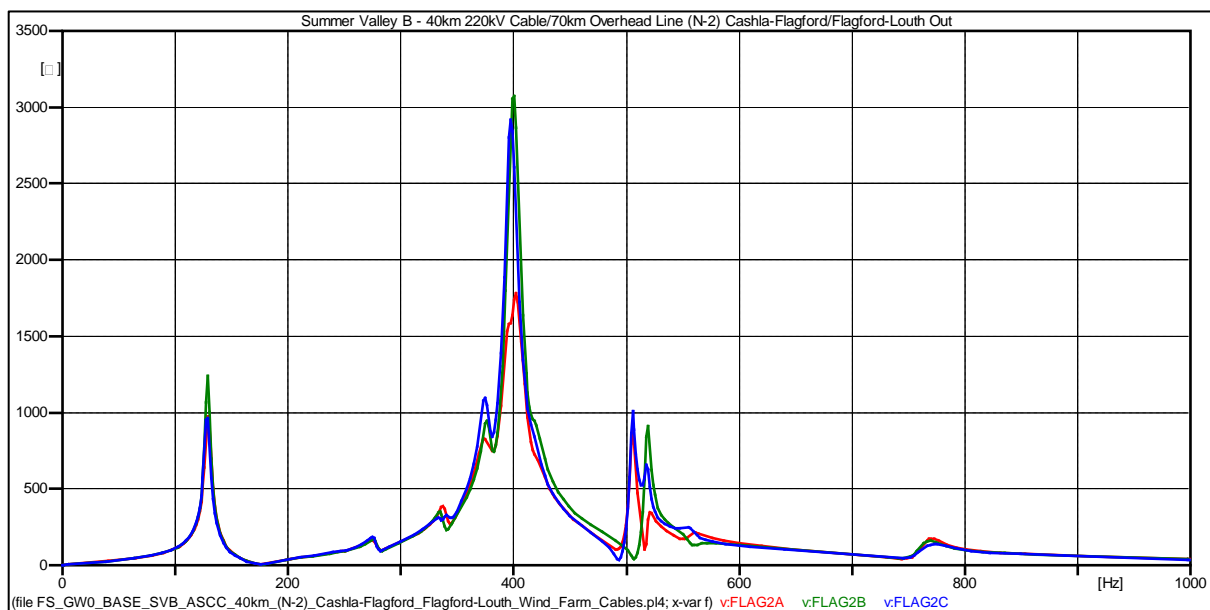


Figure 19: SVB - Length 40 km / 70 km OHL - (N-2) Cashla-Flagford/Flagford-Louth Lines Out

Impedance Scan - Resonance points

Frequency (Hz)	Impedance (Ω)
129.01	1238.8
399.01	3057.1
505.51	1006.9
520.51	761.29

1.6 Time Domain Simulation - Length 40 km cable / 70 km OHL – Summer Valley B – Case 3

Conditions for time domain simulation:

1. Summer Valley B network
2. Length 40 km cable / 70 km OHL

Case 3: (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out

System Conditions:

1. Fault on Flagford side of Flagford-Cashla line, applied at 0.5s.
2. Reclose sequence at 0.575s, dead time 0.6s, circuit breaker closes 1.175s, point on wave closes at 90°.
3. Breaker opens at again at 1.25s.

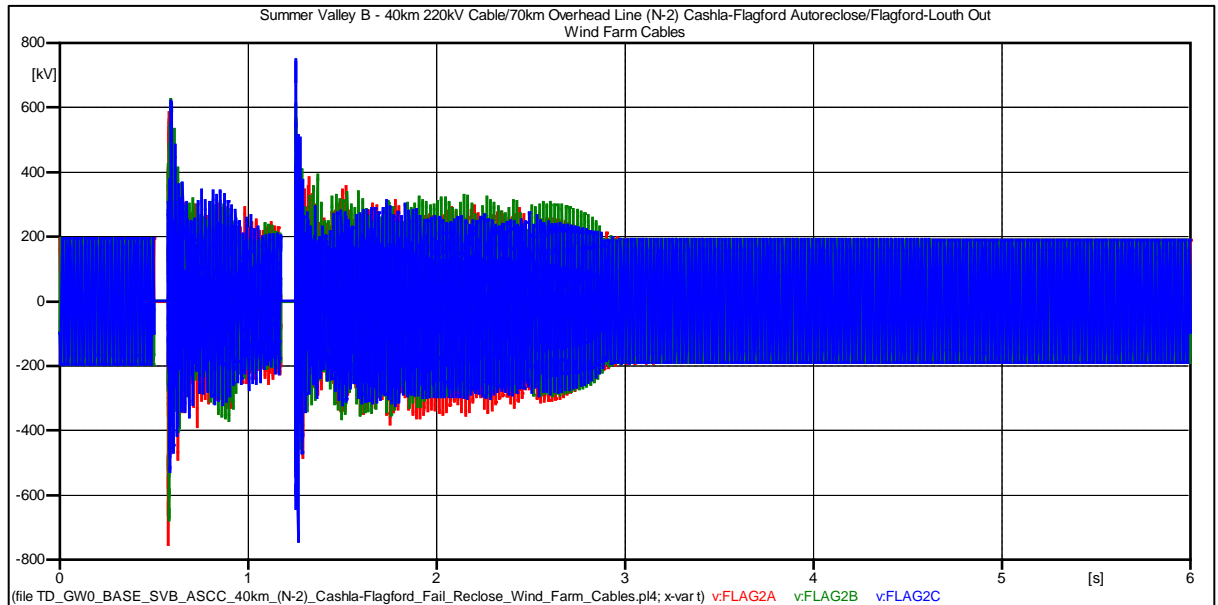


Figure 20: SVB - Length 40 km cable / 70 km OHL – Flagford – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-6s)

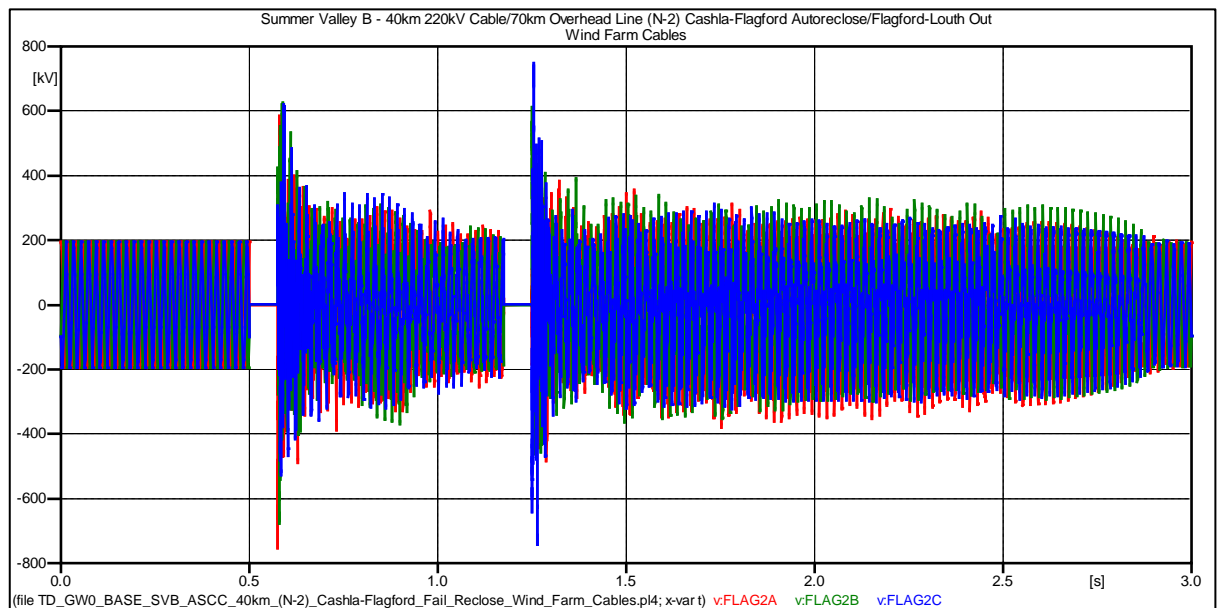


Figure 21: SVB - Length 40 km cable / 70 km OHL – Flagford – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-3s)

Condition	Maximum Value	Limit	Result
Switching	770.51 kV (4.3155 pu)	449.073 kV (2.5pu)	Fail
Temporary Overvoltage	399.56 kV (2.2371 pu)	287.32 kV (1.6 pu)	Fail

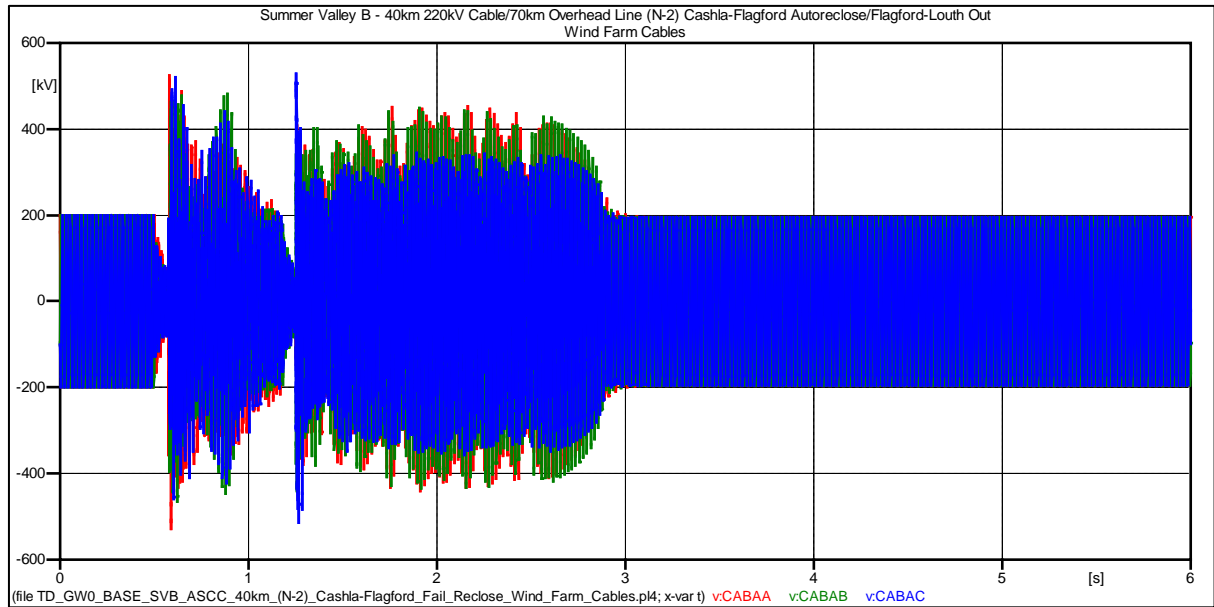


Figure 22: SVB - Length 40 km cable / 70 km OHL – Cable End A – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-6s)

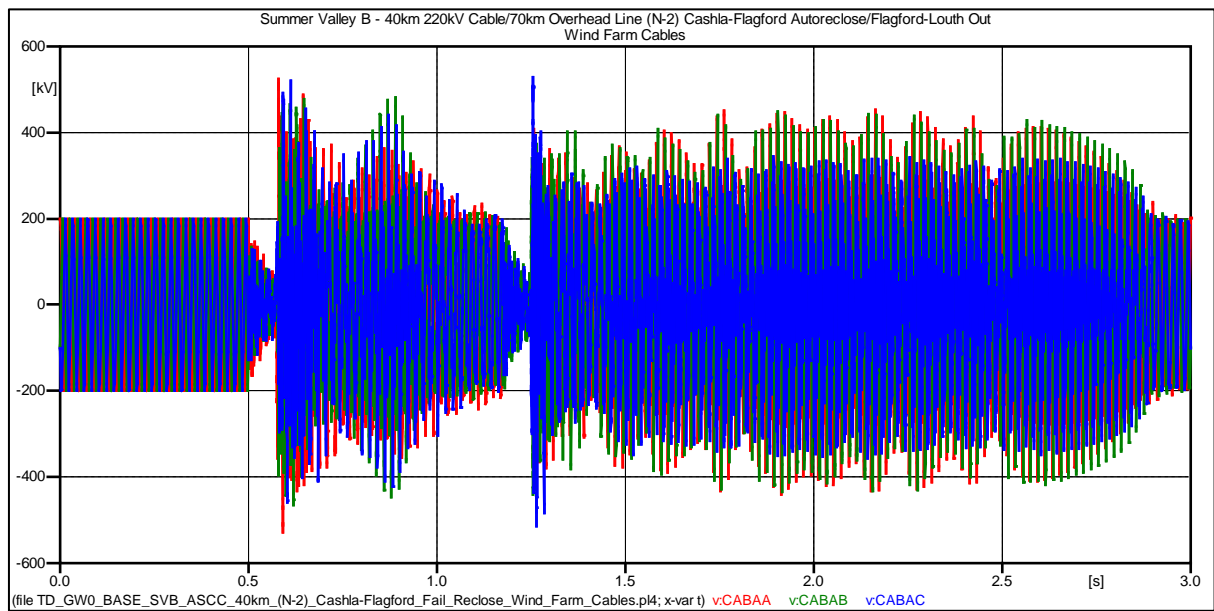


Figure 23: SVB - Length 40 km cable / 70 km OHL – Cable End A – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-3s)

Condition	Maximum Value	Limit	Result
Switching	523.12 kV (2.9298 pu)	449.073 kV (2.5pu)	Fail
Temporary Overvoltage	450.13kV (2.506 pu)	287.32 kV (1.6 pu)	Fail*

*Transformer Saturation

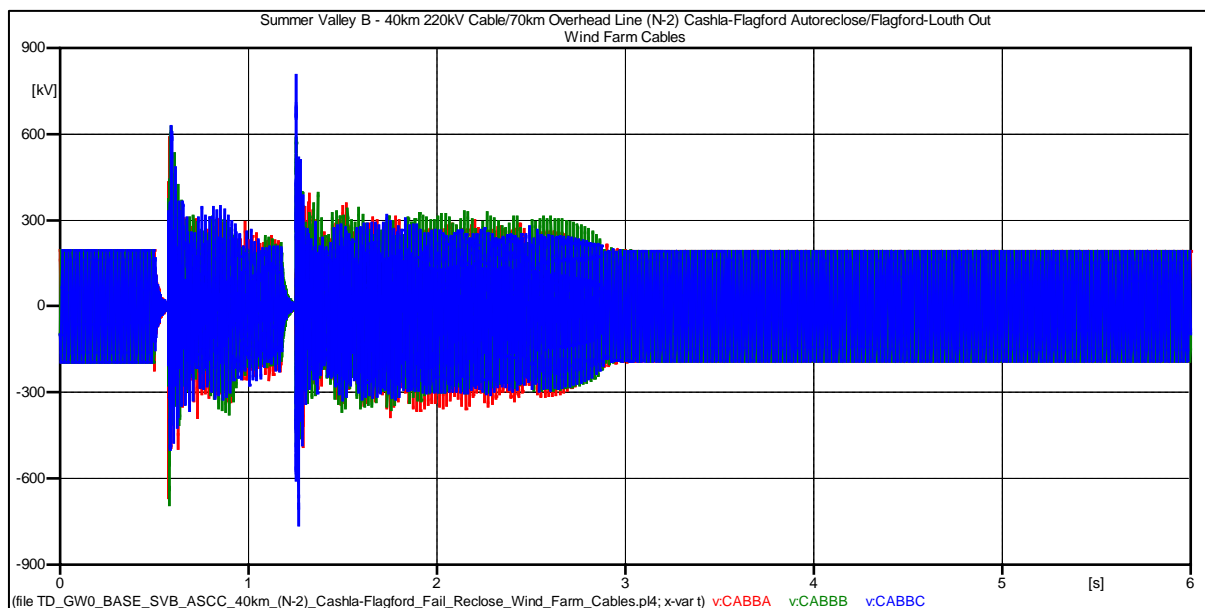


Figure 24: SVB - Length 40 km cable / 70 km OHL – Cable End B – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-3s)

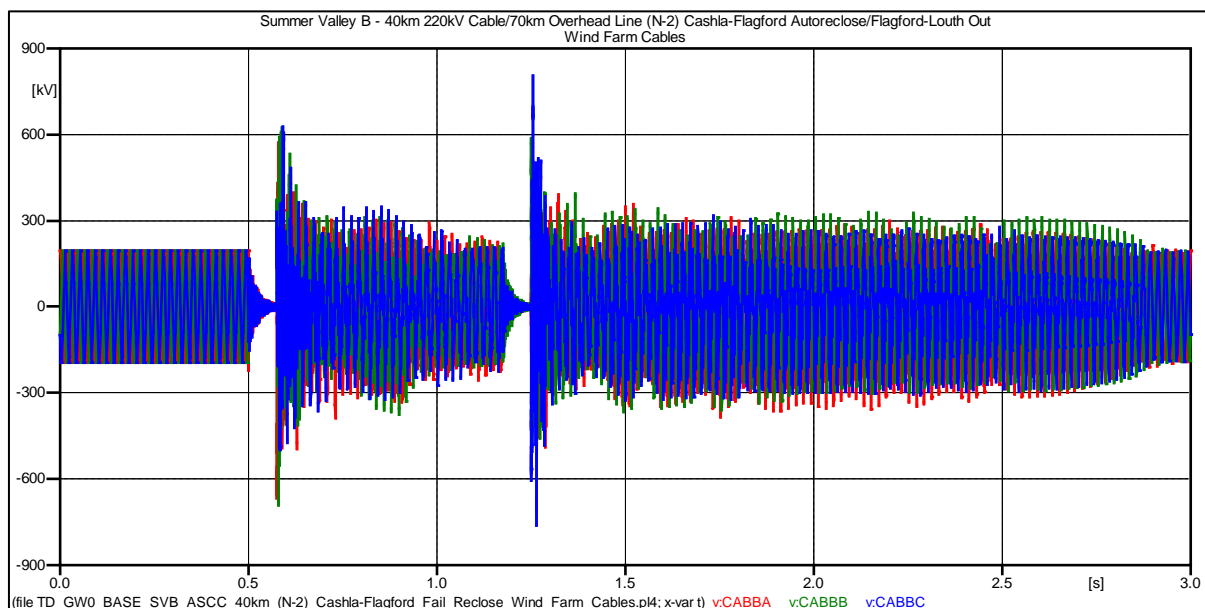


Figure 25: SVB - Length 40 km cable / 70 km OHL – Cable End B – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-3s)

Condition	Maximum Value	Limit	Result
Switching	790.23 kV (4.4256 pu)	449.073 kV (2.5pu)	Fail
Temporary Overvoltage	330.23 kV (1.8494 pu)	287.32 kV (1.6 pu)	Fail

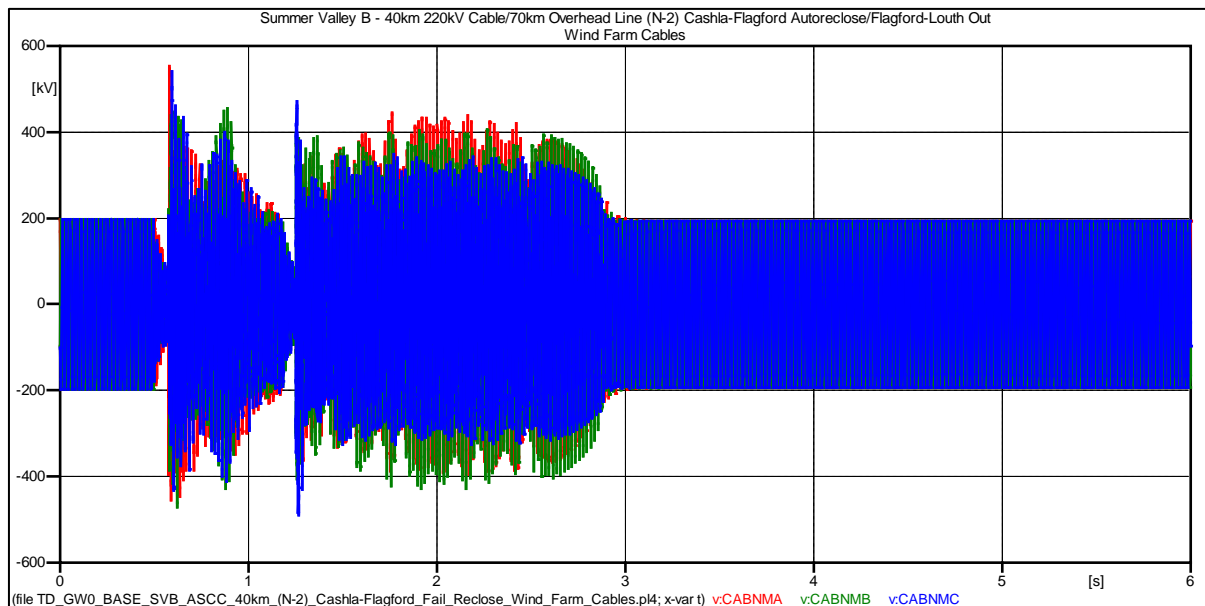


Figure 26: SVB - Length 40 km cable / 70 km OHL – North Mayo – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-6s)

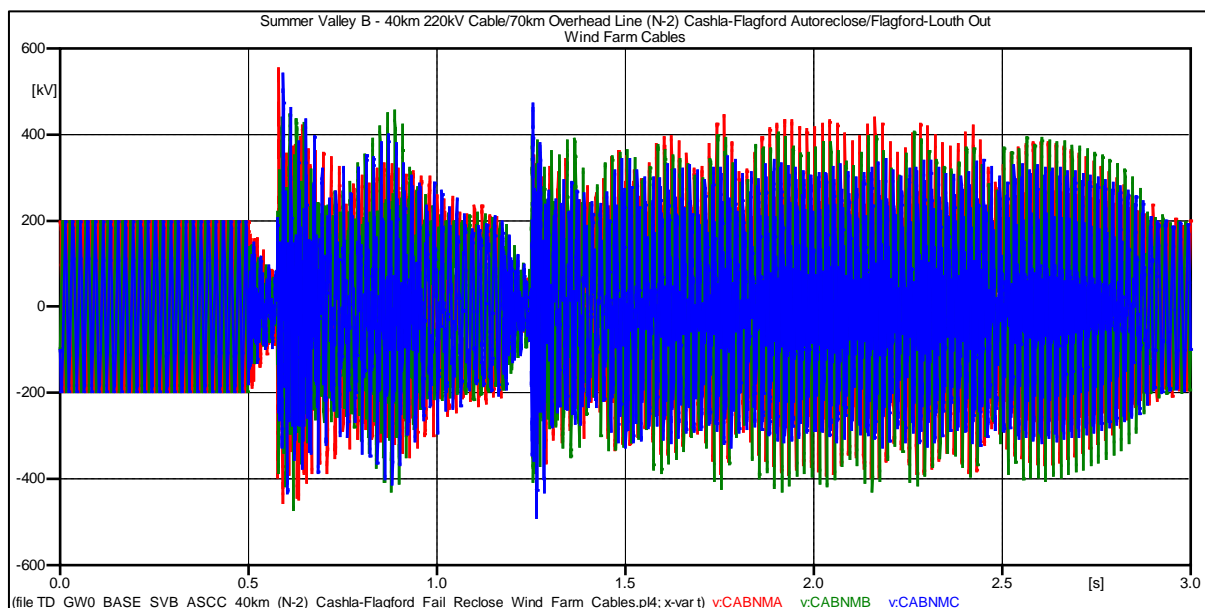


Figure 27: SVB - Length 40 km cable / 70 km OHL – North Mayo – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-3s)

Condition	Maximum Value	Limit	Result
Switching	581.52 kV (3.2567 pu)	446.375 kV (2.5 pu)	Fail
Temporary Overvoltage	421.25 kV (2.3592 pu)	310.76 kV(1.73 pu)	Fail

1.7 Impedance Scans - Length 30 km cable / 80 km OHL – Summer Valley B – Case 4

Conditions for impedance scan:

1. Summer Valley B network
2. Length – 30 km 220kV Cable/80 km Overhead Line
3. Reactors – North Mayo 60 MVar/Flagford 50 Mvar

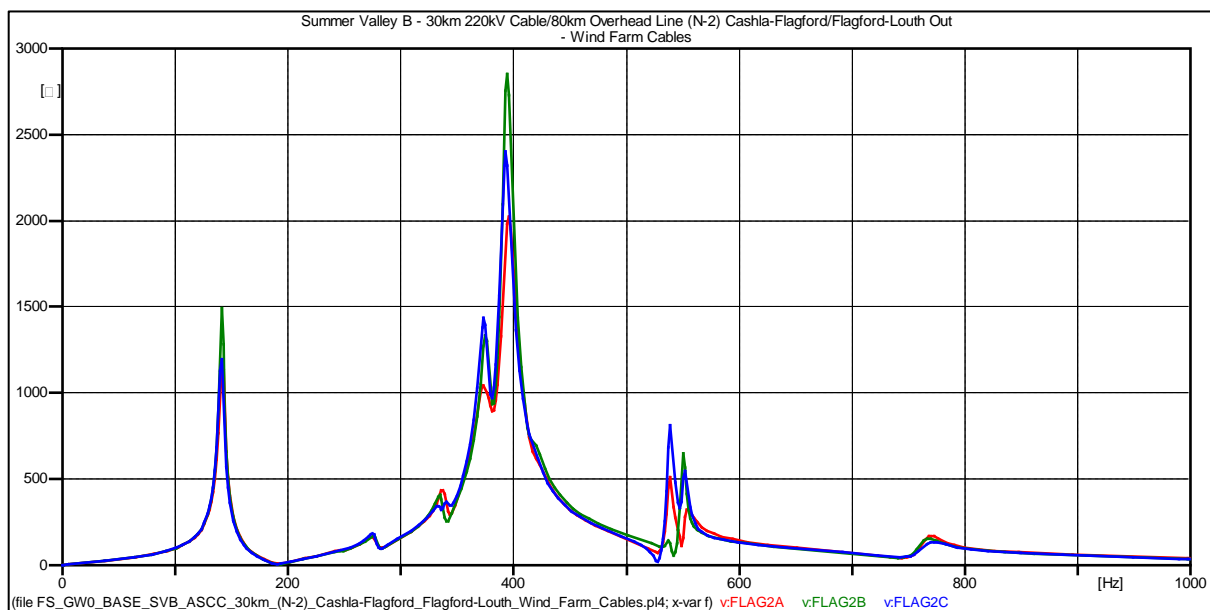


Figure 28: SVB - Length 30 km cable / 80 km OHL - (N-2) Cashla-Flagford/Flagford-Louth Lines Out

Impedance Scan - Resonance points

Frequency (Hz)	Impedance (Ω)
142.51	1281.9
393.01	2755.5
540.01	697.64

1.8 Time Domain Simulation - Length 30 km cable / 80 km OHL – Summer Valley B – Case 4

Conditions for time domain simulation:

1. Summer Valley B network
2. Length 30 km cable / 80 km OHL

Case 4: (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out

System Conditions:

1. Fault on Flagford side of Flagford-Cashla line, applied at 0.5s.
2. Reclose sequence at 0.575s, dead time 0.6s, circuit breaker closes 1.175s, point on wave closes at 90°.
3. Breaker opens at again at 1.25s.

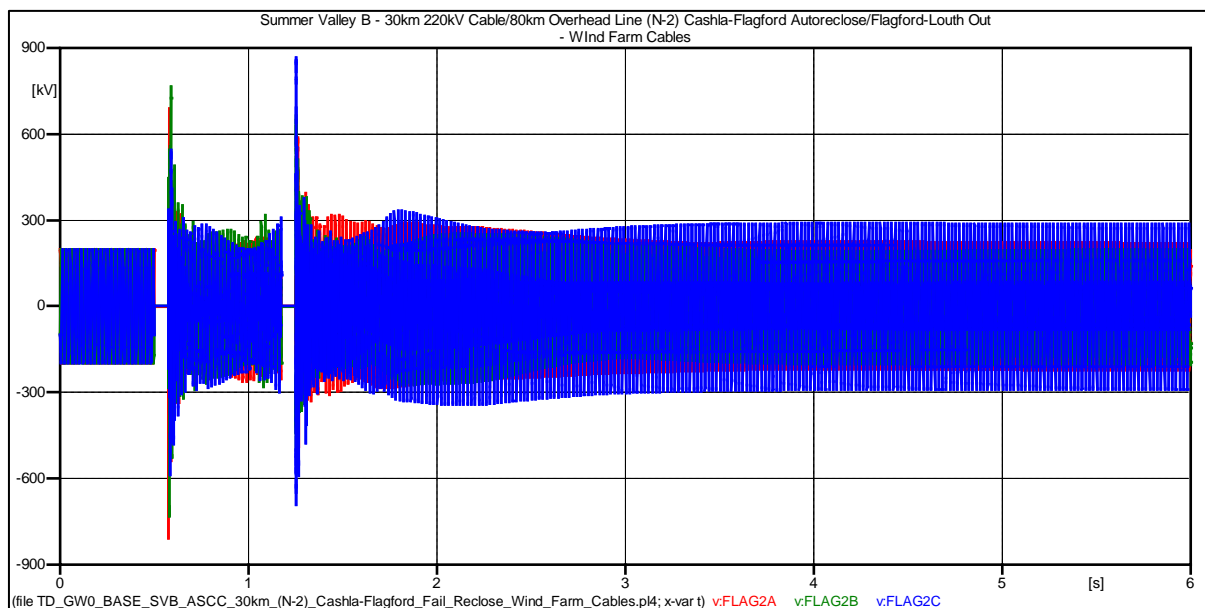


Figure 29: SVB - Length 30 km cable / 80 km OHL – Flagford – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-6s)

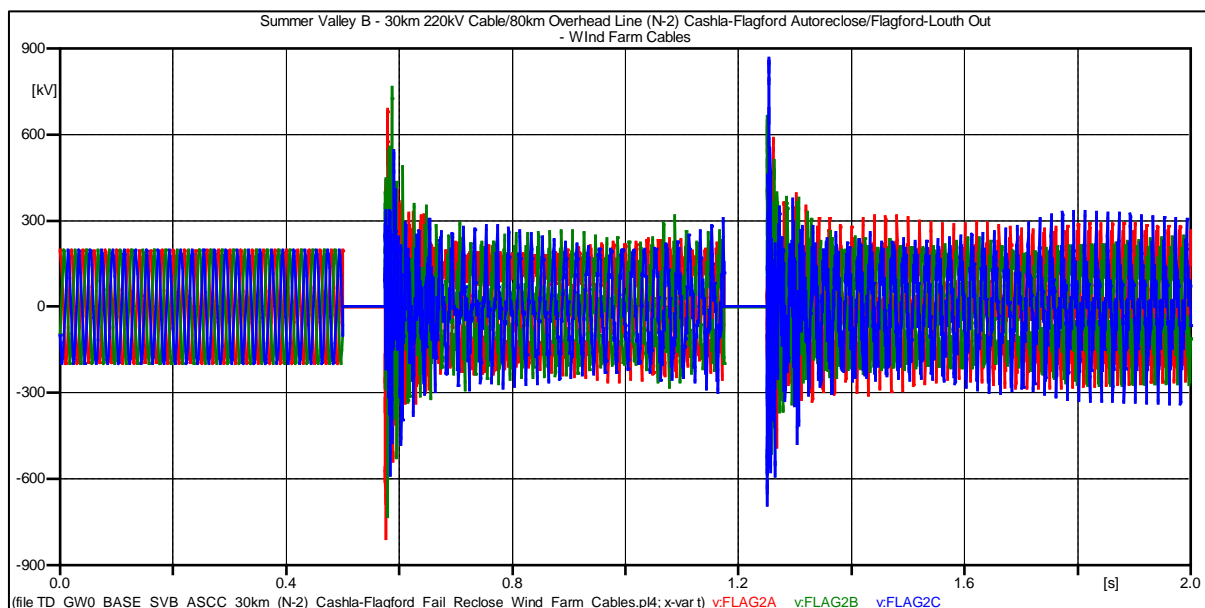


Figure 30: SVB - Length 30 km cable / 80 km OHL – Flagford – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-2s)

Condition	Maximum Value	Limit	Result
Switching	880.51 kV (4.9312 pu)	446.375 kV (2.5 pu)	Fail
Temporary Overvoltage	341.23 kV (1.9110 pu)	310.76 kV(1.73 pu)	Fail

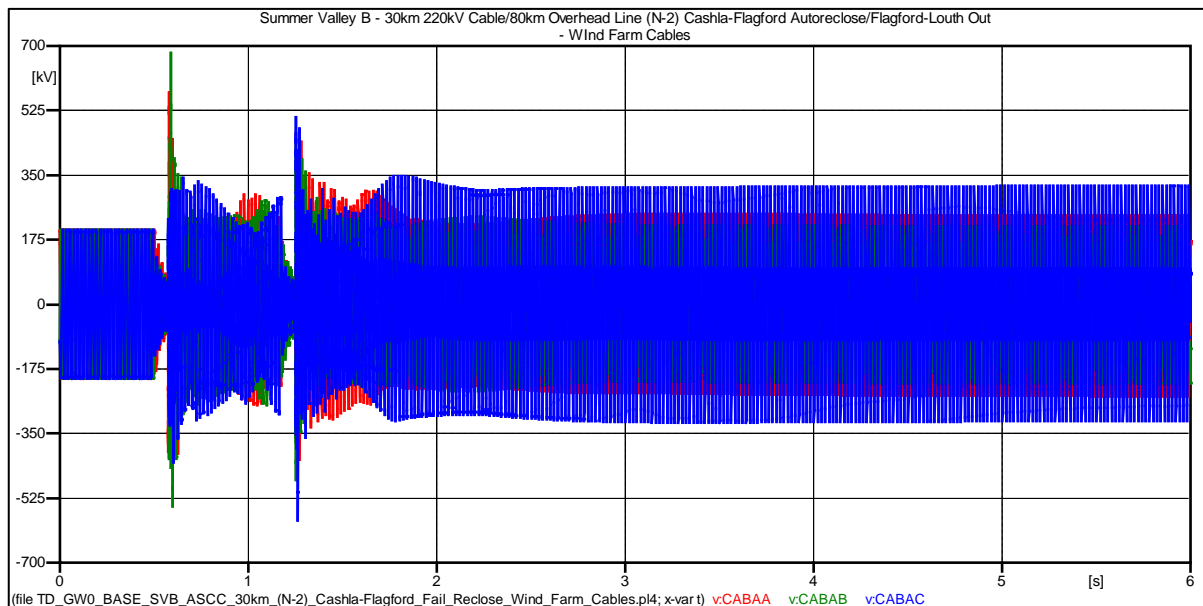


Figure 31: SVB - Length 30 km cable / 80 km OHL – Cable End A – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-6s)

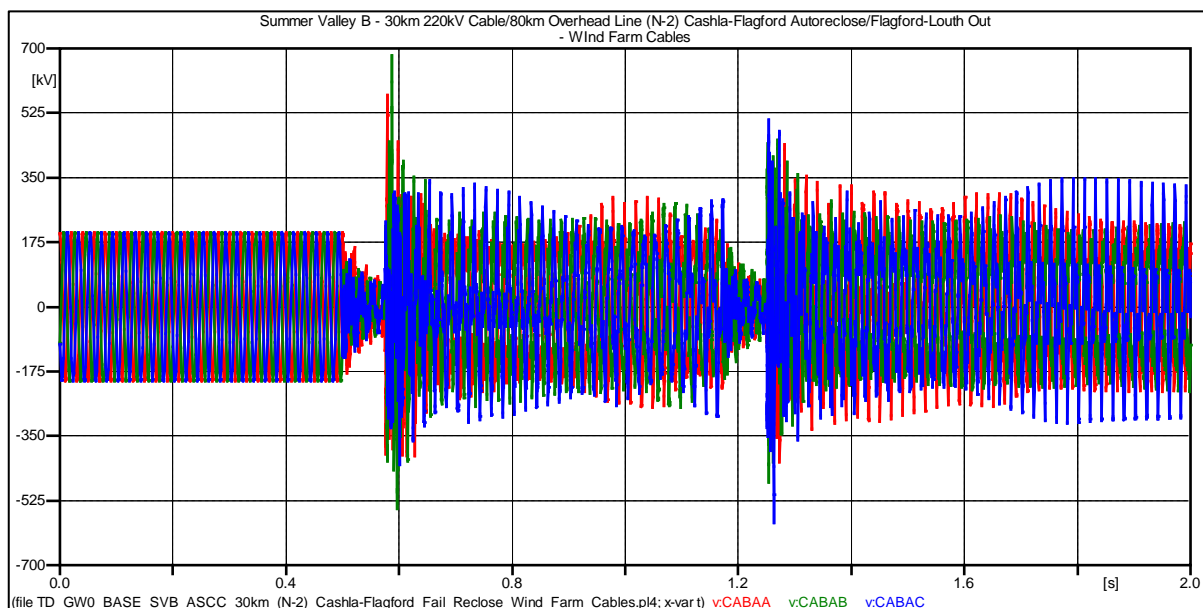


Figure 32: SVB - Length 30 km cable / 80 km OHL – Cable End A – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-2s)

Condition	Maximum Value	Limit	Result
Switching	690.21 kV (4.9312 pu)	449.073 kV (2.5pu)	Fail
Temporary Overvoltage	401.23 kV (2.234 pu)	287.32 kV (1.6 pu)	Fail

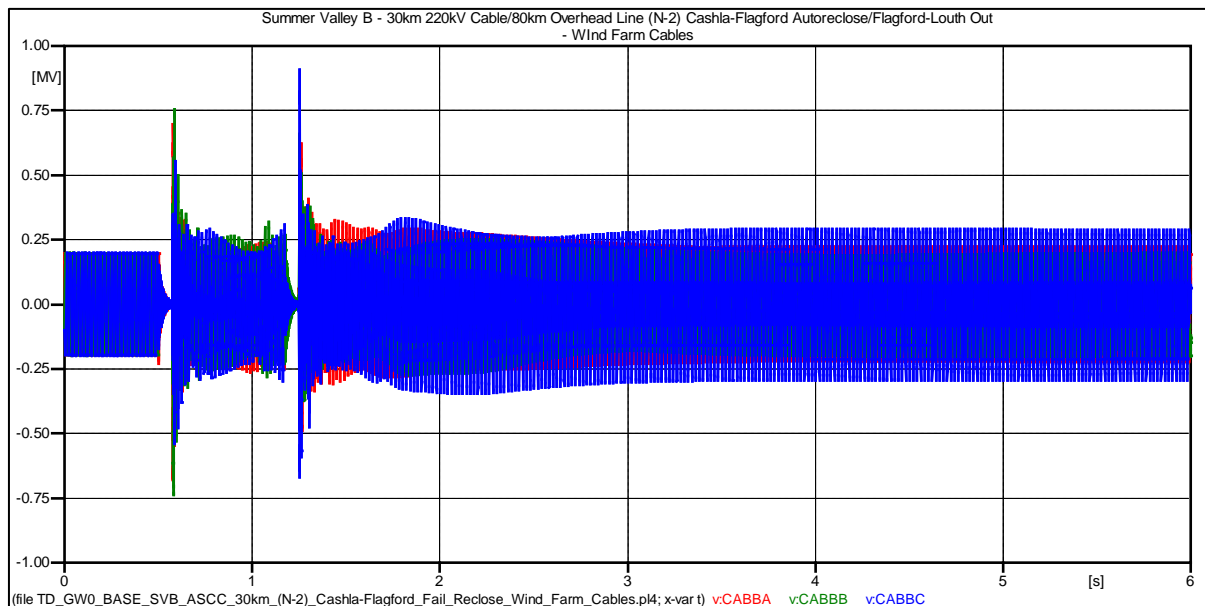


Figure 33: SVB - Length 30 km cable / 80 km OHL – Cable End B – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-6s)

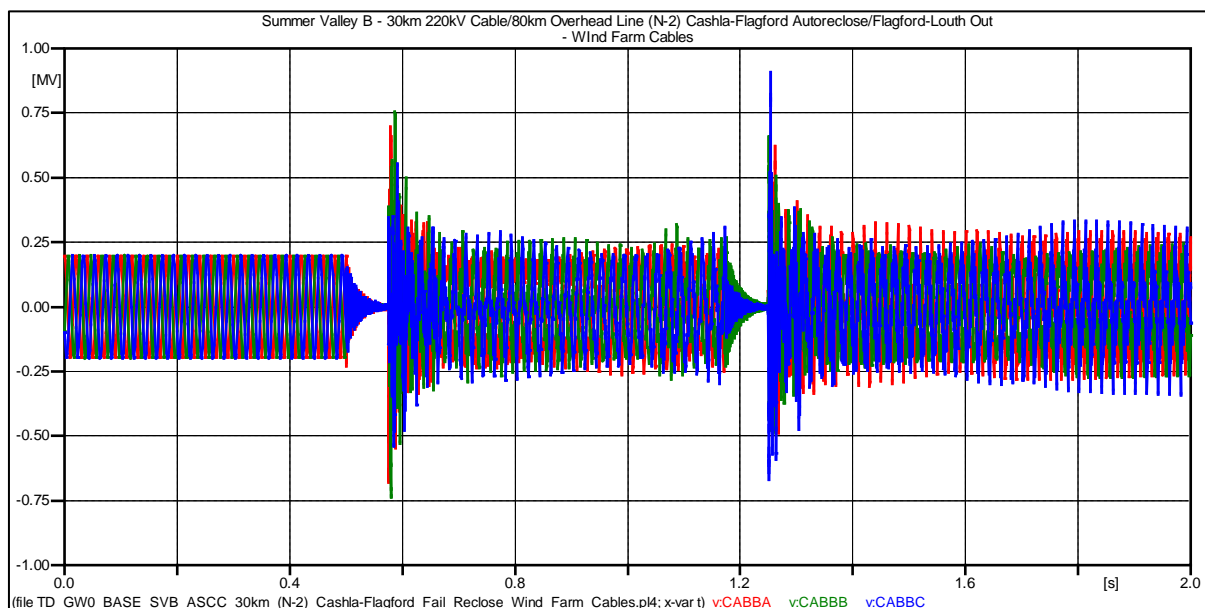


Figure 34: SVB - Length 30 km cable / 80 km OHL – Cable End B – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-2s)

Condition	Maximum Value	Limit	Result
Switching	920.12 kV (5.153 pu)	446.375 kV (2.5 pu)	Fail
Temporary Overvoltage	320.12 kV (1.792 pu)	310.76 kV(1.73 pu)	Fail

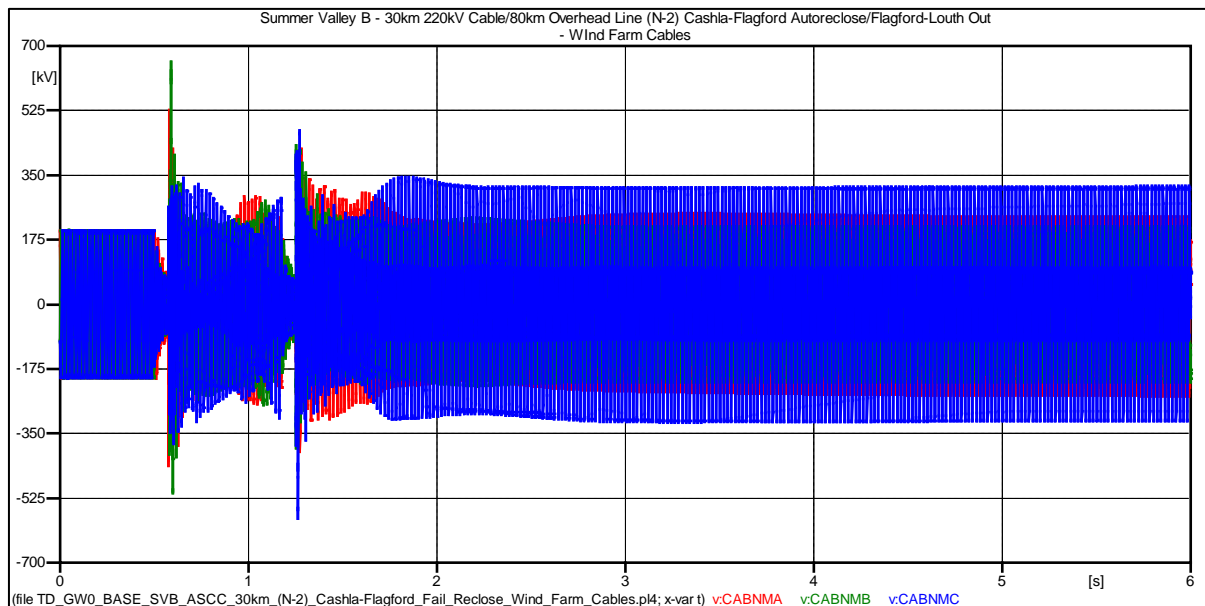


Figure 35: SVB - Length 30 km cable / 80 km OHL – North Mayo – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-6s)

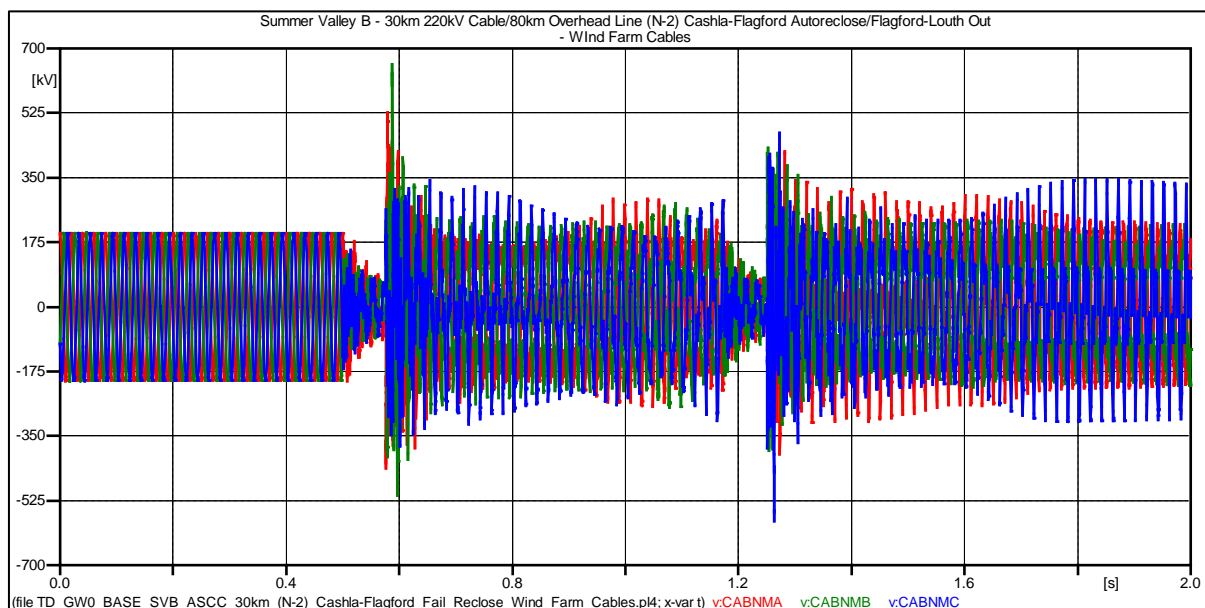


Figure 36: SVB - Length 30 km cable / 80 km OHL – North Mayo – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-2s)

Condition	Maximum Value	Limit	Result
Switching	660.58 kV (3.6784 pu)	449.073 kV (2.5pu)	Fail
Temporary Overvoltage	370.89 kV (2.065 pu)	287.32 kV (1.6 pu)	Fail

1.9 Impedance Scans - Length 20 km cable / 90 km OHL – Summer Valley B – Case 5

Conditions for impedance scan:

1. Summer Valley B network
2. Length – 20 km 220kV Cable/90 km Overhead Line
3. Reactors – North Mayo 40 MVar/Flagford 30 MVar

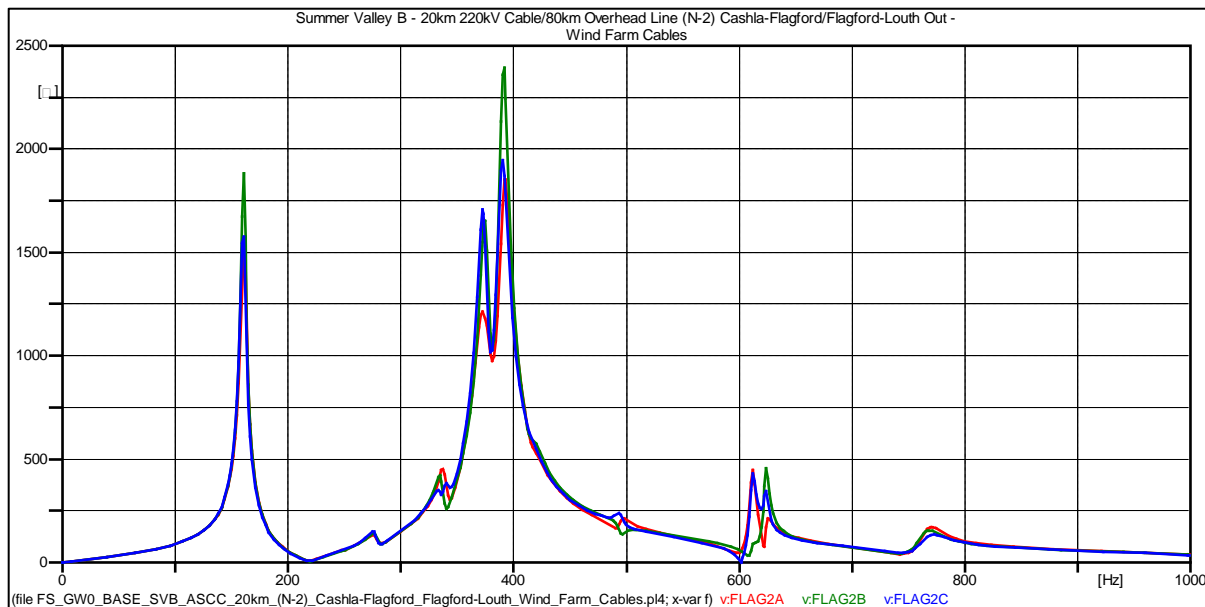


Figure 37: SVB - Length 20 km cable / 90 km OHL - (N-2) Cashla-Flagford/Flagford-Louth Lines Out

Impedance Scan - Resonance points

Frequency (Hz)	Impedance (Ω)
162.01	1575.0
373.50	1684.6
391.51	2392.6
613.51	391.54

1.10 Time Domain Simulation - Length 20 km cable / 90 km OHL – Summer Valley B – Case 5

Conditions for time domain simulation:

1. Summer Valley B network
2. Length 20 km cable / 90 km OHL

Case 5: (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out

System Conditions:

1. Fault on Flagford side of Flagford-Cashla line, applied at 0.5s.
2. Reclose sequence at 0.575s, dead time 0.6s, circuit breaker closes 1.175s, point on wave closes at 90°.
3. Breaker opens at again at 1.25s.

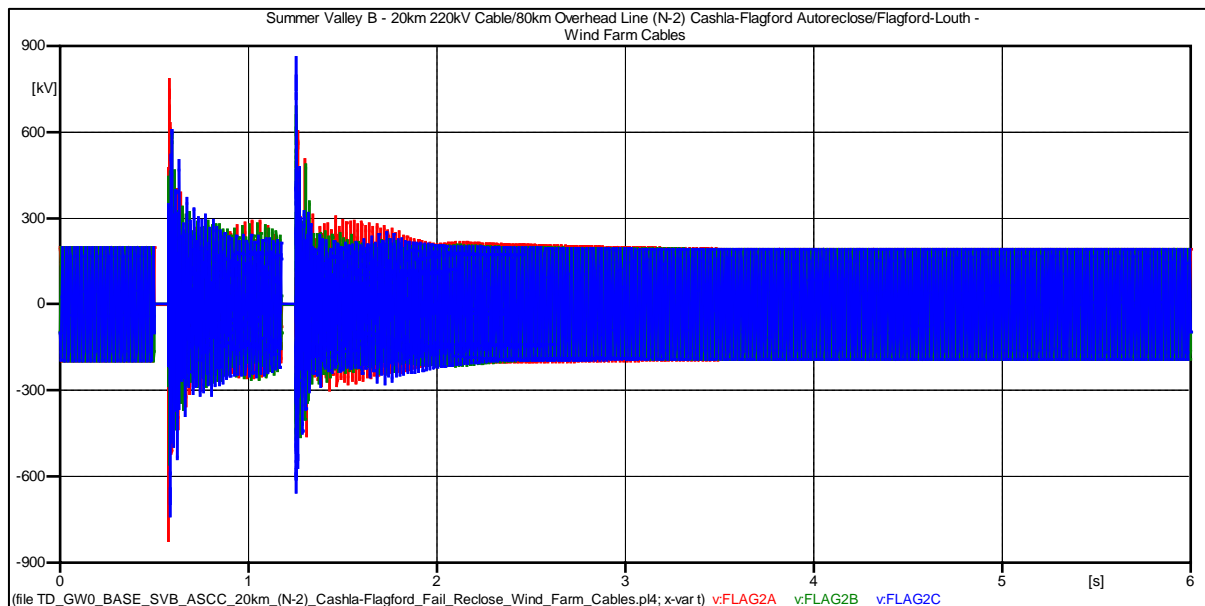


Figure 38: SVB - Length 20 km cable / 90 km OHL – Flagford – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-6s)

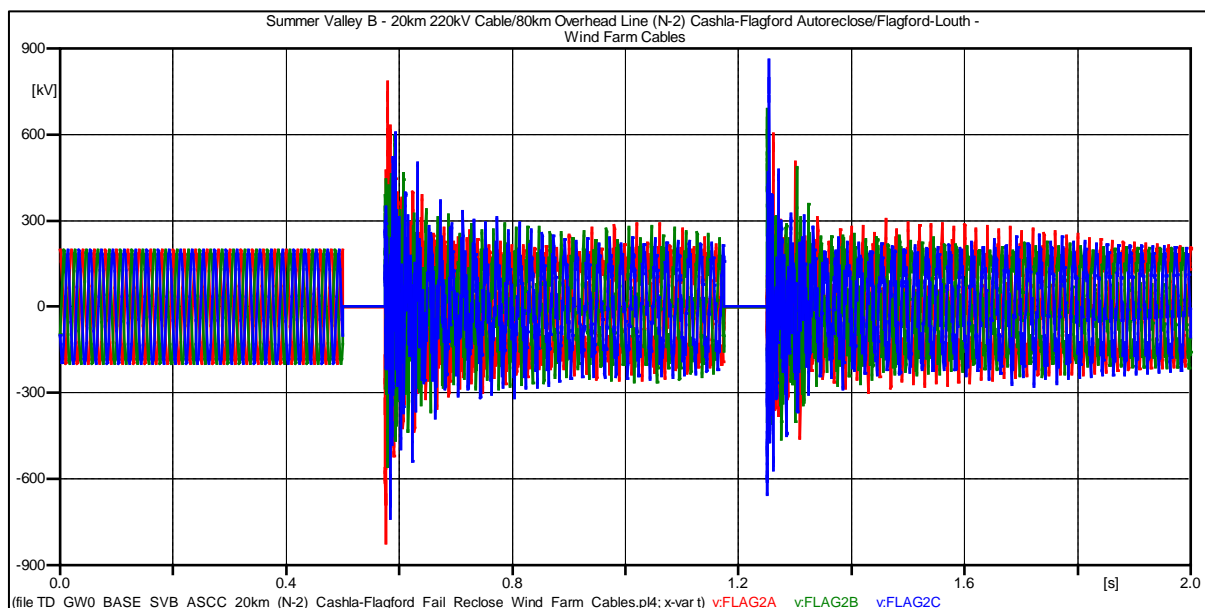


Figure 39: SVB - Length 20 km cable / 90 km OHL – Flagford – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-2s)

Condition	Maximum Value	Limit	Result
Switching	861.25 kV (4.795 pu)	449.073 kV (2.5pu)	Fail
Temporary Overvoltage	478.64 kV (2.665 pu)	287.32 kV (1.6 pu)	Fail

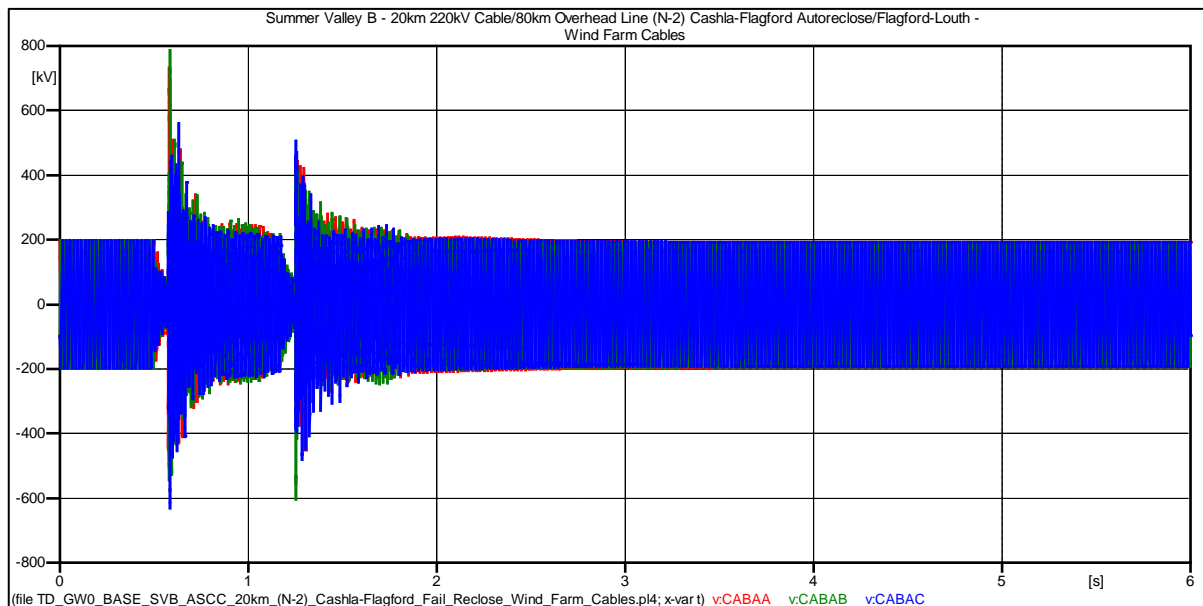


Figure 40: SVB - Length 20 km cable / 90 km OHL – Cable End A – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-6s)

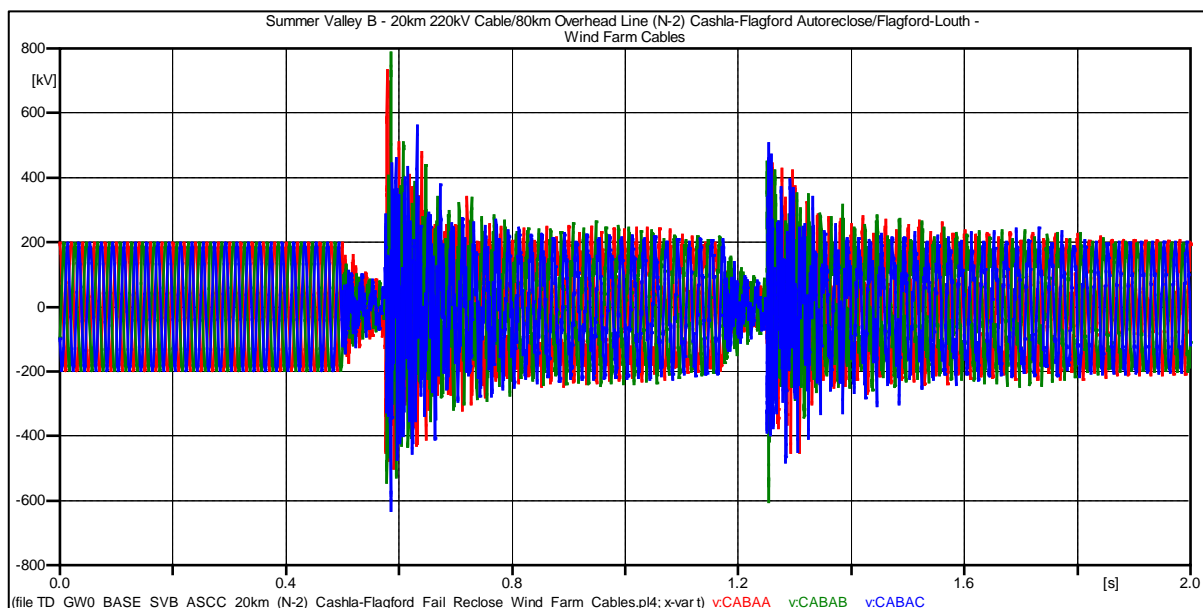


Figure 41: SVB - Length 20 km cable / 90 km OHL – Cable End A – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-2s)

Condition	Maximum Value	Limit	Result
Switching	781.26 kV (4.350pu)	449.073 kV (2.5pu)	Fail
Temporary Overvoltage	560.28 kV (3.119 pu)	287.32 kV (1.6 pu)	Fail

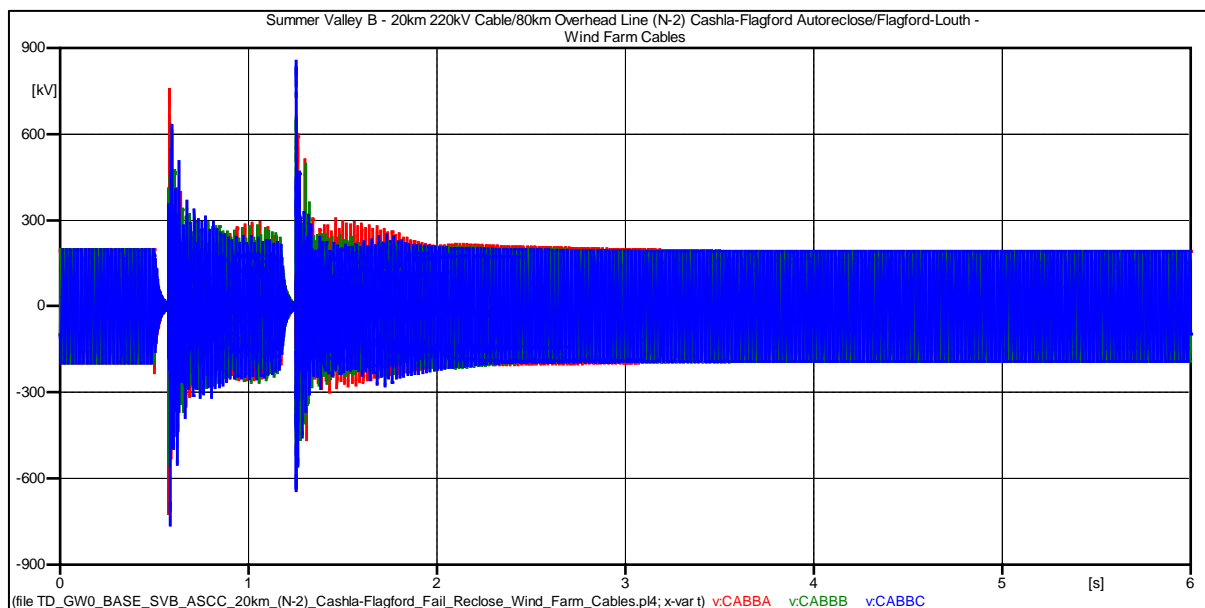


Figure 42: SVB - Length 20 km cable / 90 km OHL – Cable End B – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-6s)

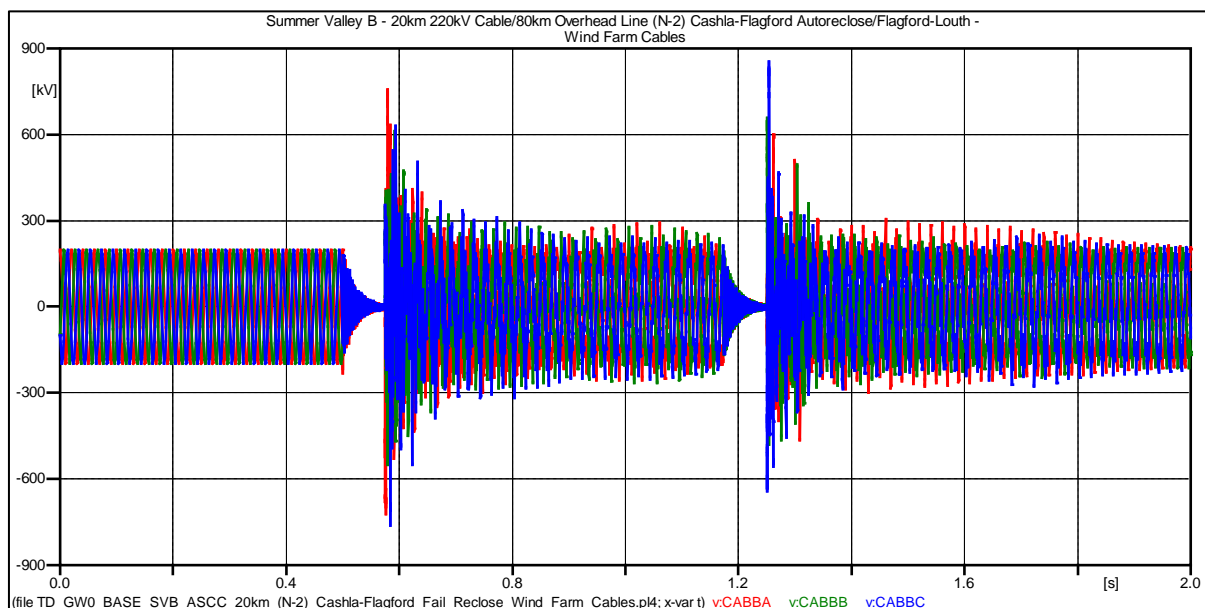


Figure 43: SVB - Length 20 km cable / 90 km OHL – Cable End B – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-2s)

Condition	Maximum Value	Limit	Result
Switching	715.45 kV (3.984 pu)	449.073 kV (2.5pu)	Fail
Temporary Overvoltage	487.67 kV (2.715 pu)	287.32 kV (1.6 pu)	Fail

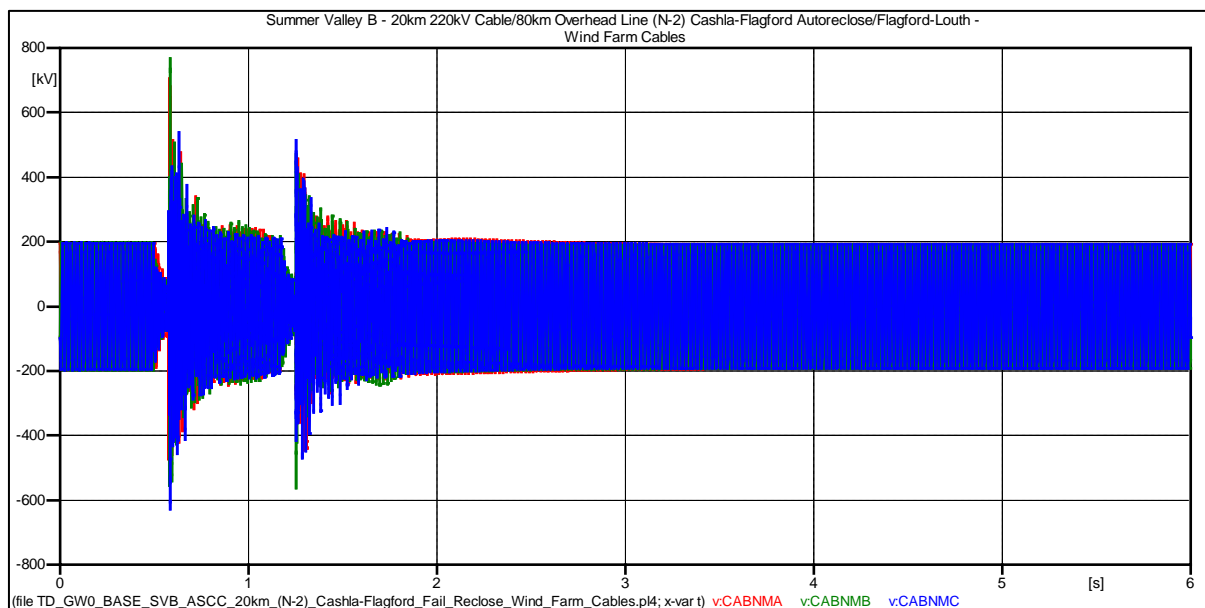


Figure 44: SVB - Length 20 km cable / 90 km OHL – North Mayo – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-6s)

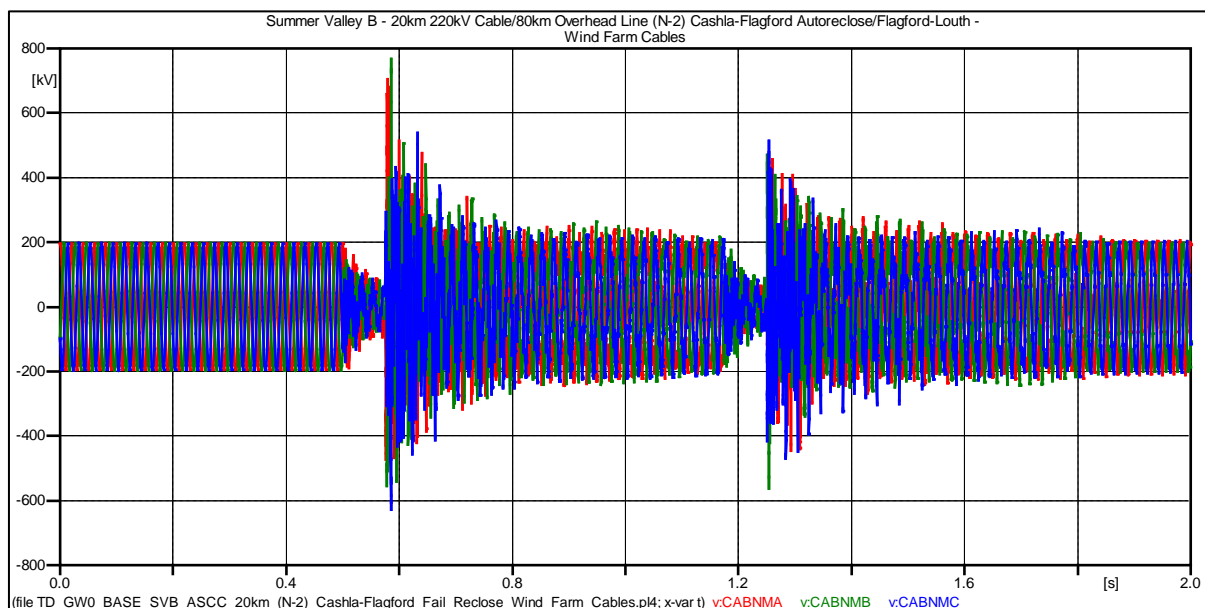


Figure 45: SVB - Length 20 km cable / 90 km OHL – North Mayo – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-2s)

Condition	Maximum Value	Limit	Result
Switching	779.67 kV (4.341 pu)	449.073 kV (2.5pu)	Fail
Temporary Overvoltage	524.21 kV (2.919 pu)	287.32 kV (1.6 pu)	Fail

1.11 Impedance Scans - Length 20 km cable / 90 km OHL – Winter Peak A – Case 6

Conditions for impedance scan:

1. Winter Peak A network
2. Length – 20 km 220kV Cable/90 km Overhead Line
3. Reactors – North Mayo 40 MVar/Flagford 30 MVar

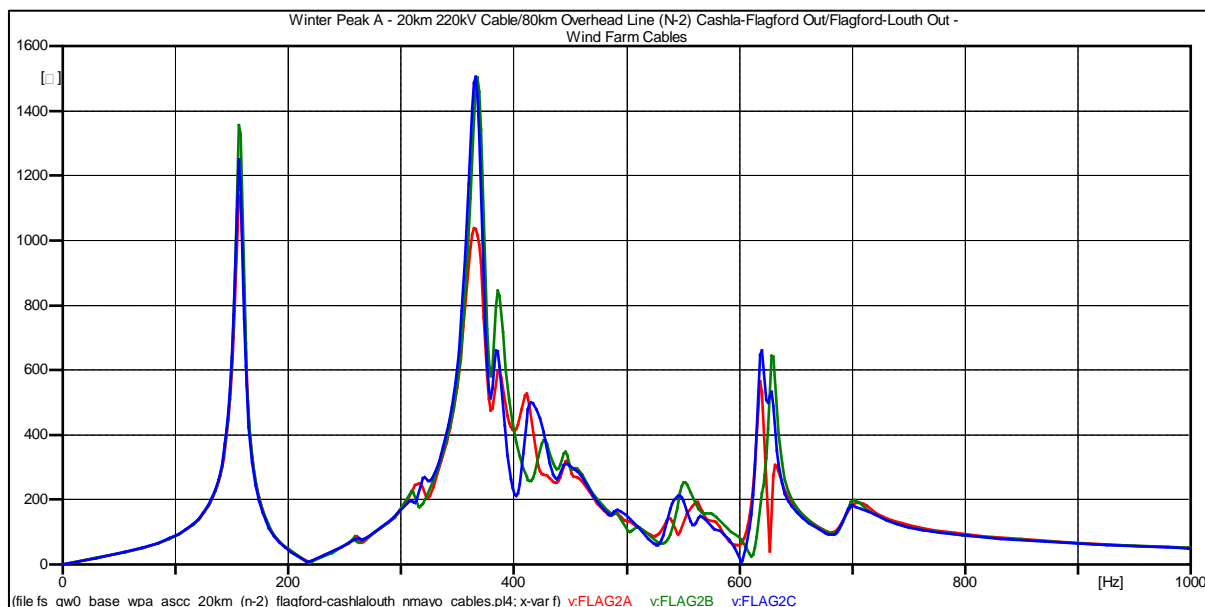


Figure 46: WPA - Length 20 km cable / 90 km OHL - (N-2) Cashla-Flagford/Flagford-Louth Lines Out

Impedance Scan - Resonance points

Frequency (Hz)	Impedance (Ω)
157.01	1325.5
367.51	1501.8
619.51	660.98
630.01	641.47

1.12 Time Domain Simulation - Length 20 km cable / 90 km OHL – Winter Peak A – Case 6

Conditions for time domain simulation:

1. Winter Peak A network
2. Length 20 km cable / 90 km OHL
3. Reactors – North Mayo 40 MVar/Flagford 30 MVar

Case 6: (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out

System Conditions:

1. Fault on Flagford side of Flagford-Cashla line, applied at 0.5s.
2. Reclose sequence at 0.575s, dead time 0.6s, circuit breaker closes 1.175s, point on wave closes at 90°.
3. Breaker opens again at 1.25s.

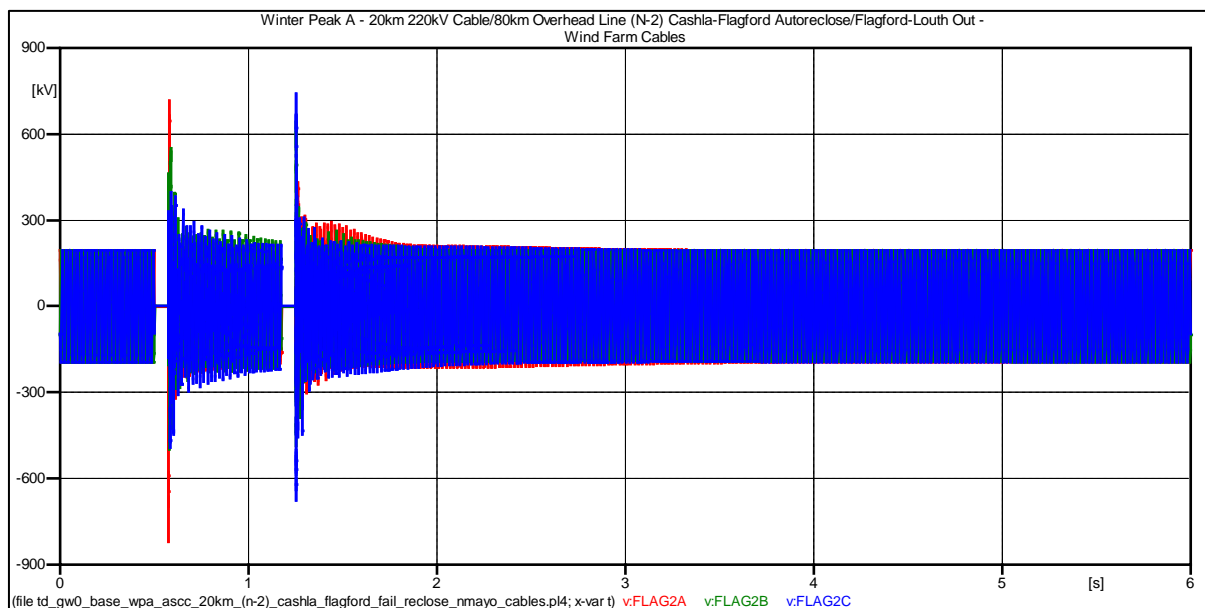


Figure 47: WPA - Length 20 km cable / 90 km OHL – Flagford – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-6s)

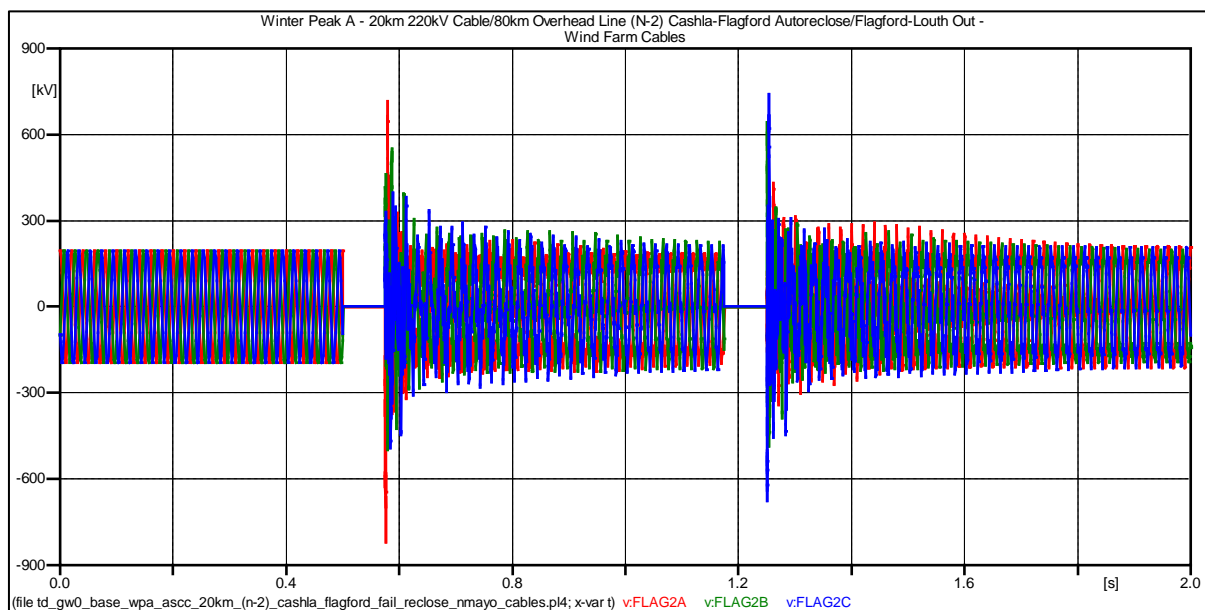


Figure 48: WPA - Length 20 km cable / 90 km OHL – Flagford – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-2s)

Condition	Maximum Value	Limit	Result
Switching	725.67 kV (4.040pu)	449.073 kV (2.5pu)	Fail
Temporary Overvoltage	345.15 kV (1.921pu)	287.32 kV (1.6 pu)	Fail

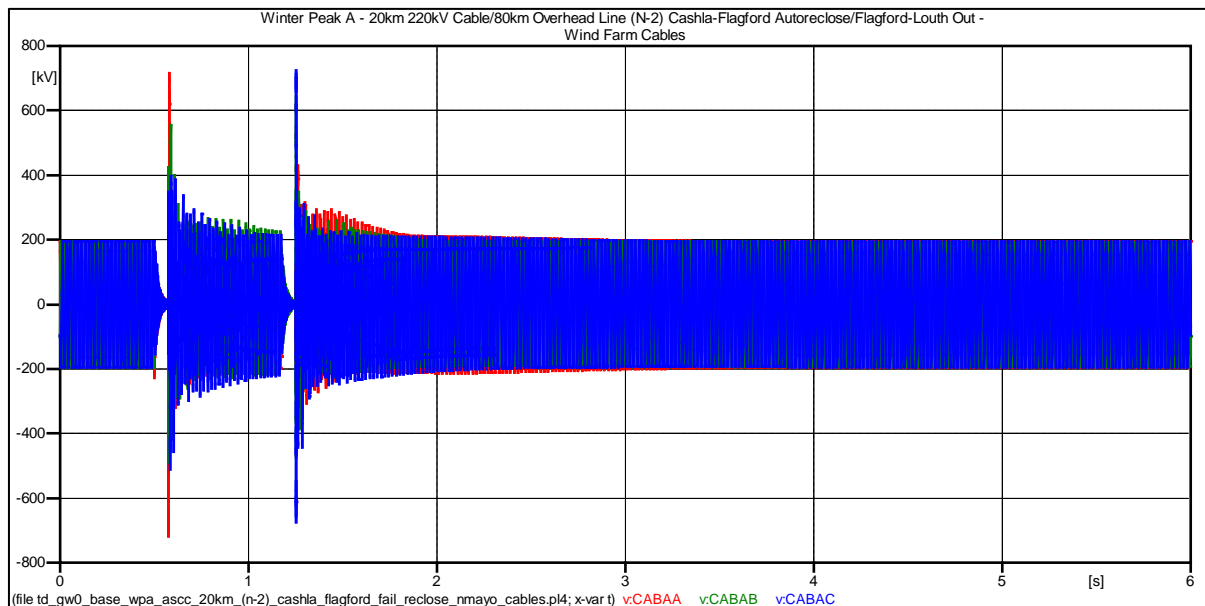


Figure 49: WPA - Length 20 km cable / 90 km OHL – Cable End A – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-6s)

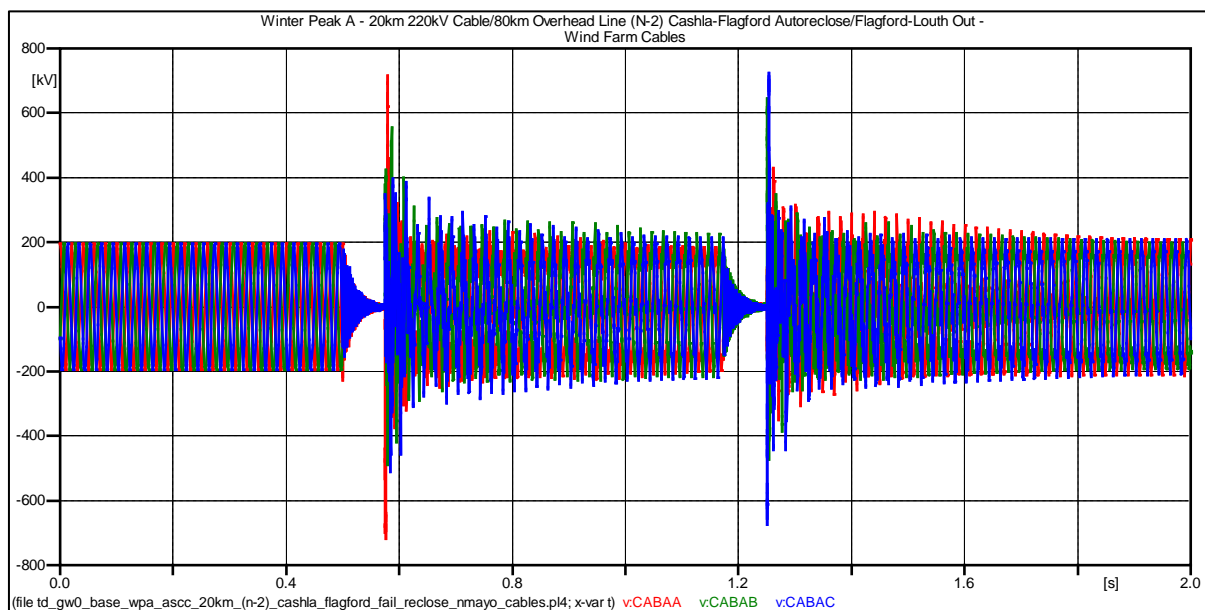


Figure 50: WPA - Length 20 km cable / 90 km OHL – Cable End A – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-2s)

Condition	Maximum Value	Limit	Result
Switching	690.89 kV (3.847 pu)	449.073 kV (2.5pu)	Fail
Temporary Overvoltage	398.16 kV (2.217 pu)	287.32 kV (1.6 pu)	Fail

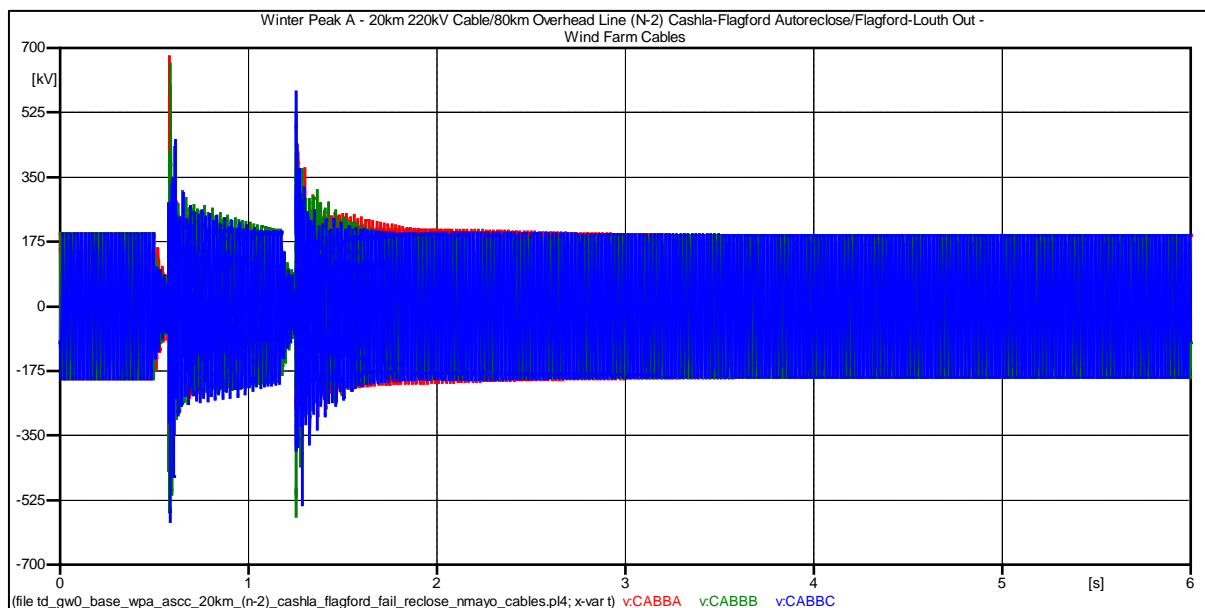


Figure 51: WPA - Length 20 km cable / 90 km OHL – Cable End B – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-6s)

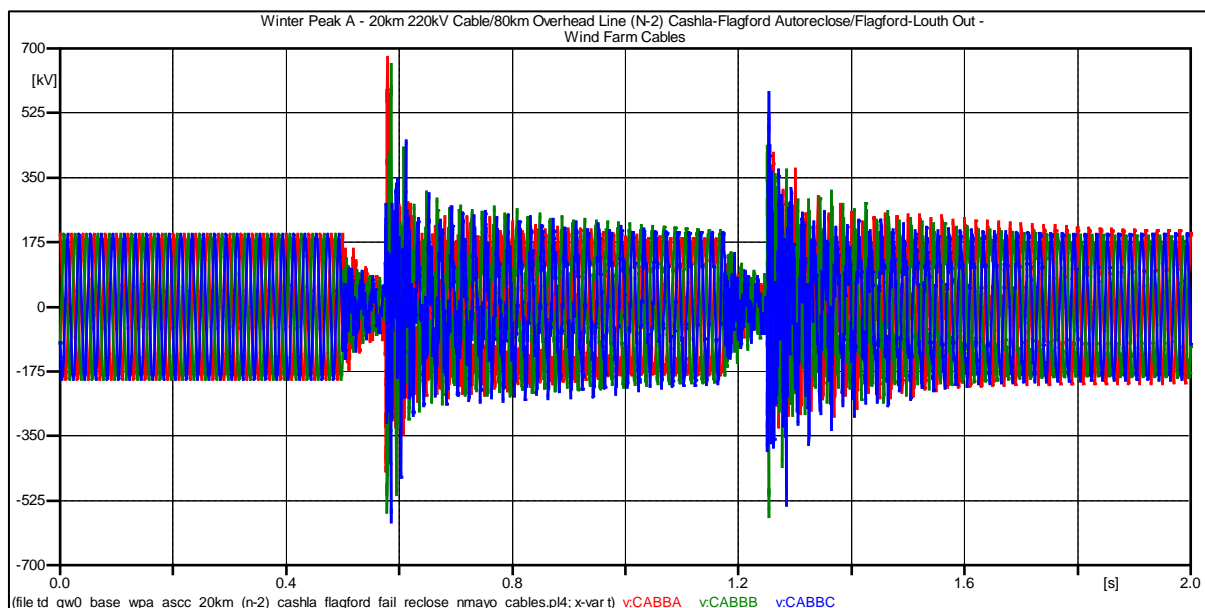


Figure 52: WPA - Length 20 km cable / 90 km OHL – Cable End B – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-2s)

Condition	Maximum Value	Limit	Result
Switching	685.95 kV (3.819 pu)	449.073 kV (2.5pu)	Fail
Temporary Overvoltage	305.27 kV (1.699 pu)	287.32 kV (1.6 pu)	Fail

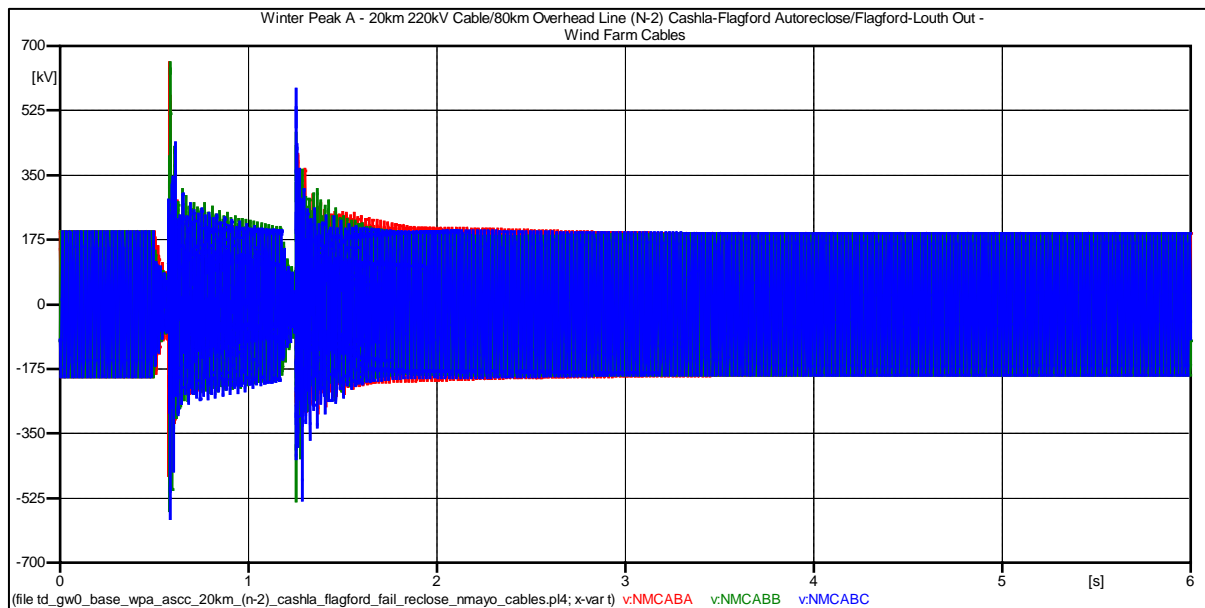


Figure 53: WPA - Length 20 km cable / 90 km OHL – North Mayo – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-6s)

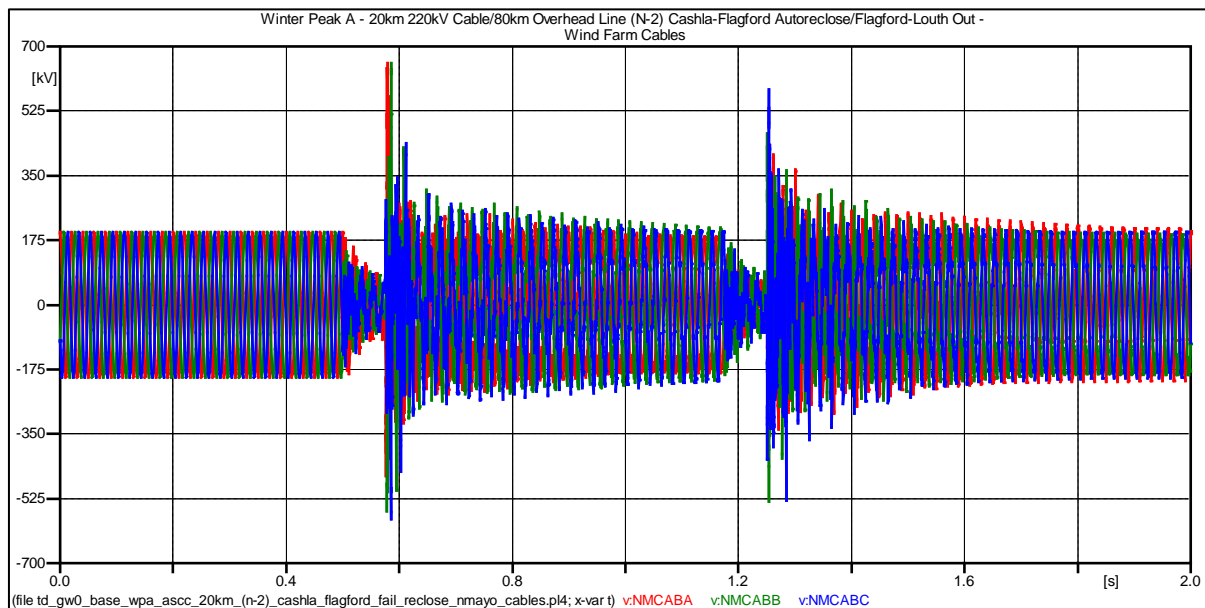


Figure 54: WPA - Length 20 km cable / 90 km OHL – North Mayo – (N-2) Cashla-Flagford Auto Reclose onto Fault/Flagford-Louth Lines Out (0-2s)

Condition	Maximum Value	Limit	Result
Switching	654.23 kV (3.643pu)	449.073 kV (2.5pu)	Fail
Temporary Overvoltage	363.52 kV (2.024pu)	287.32 kV (1.6 pu)	Fail