Generation Interconnection Feasibility Study Report

PJM Generation Interconnection Request Queue Position #S-049 Bedford 115 kV 202MW (40.4MW capacity)

May 2009

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Preface

The intent of the Generation Interconnection Feasibility Study is to determine a plan, with ballpark cost and construction time estimates, to connect the subject generation interconnection project to the PJM network at a location specified by the Interconnection Customer. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system.

The proposed interconnection facilities must be designed in accordance with the FirstEnergy "Requirements for Transmission Connected Facilities" document. Procedures for gaining access to these standards can be found at the link below.

http://www.pjm.com/planning/design-engineering/to-tech-standards.aspx

In some instances an Interconnection Customer may not be responsible for 100% of the identified Network Upgrade cost because other transmission network uses, e.g. another generation interconnection or merchant transmission upgrade, may also contribute to the need for the same network reinforcement. The possibility of sharing the reinforcement costs with other projects may be identified in the Generation Interconnection Feasibility Study, but the actual allocation will be deferred until the System Impact Study is performed.

The Generation Interconnection Feasibility Study estimates do not include the feasibility, cost, or time required to obtain property rights and permits for construction of the required facilities unless noted in the report. The project Interconnection Customer is responsible for acquiring any necessary right of way and real estate, as well as applying for and obtaining any and all permits unless prior agreement by interested parties allows for other arrangements. For properties currently owned by Transmission Owners, some permitting and real estate costs may be included in the study.

Cost and Timing Estimates

The estimates in this report do not include tax gross-up.

While the information in this transmittal is reasonable for the scope of work defined, it should, however, be noted that the cost figures and time estimates are conceptual in nature at this stage, as an engineering team has not been assigned to the project. Any change to the scope of work will require that the estimates be revisited. The costs are a best estimate, but the Interconnection Customer will be charged for actual costs. Any under-runs or over-runs will be reconciled at the conclusion of the project.

General
The Queue Position #S-049 project was studied as a 202 MW injection (40.4 MW of capacity) at the Saxton 115 kV substation. Queue Position #S-049 was evaluated for compliance with reliability criteria in accordance with the procedures set forth in PJM Manual 14A and the FirstEnergy planning criteria for summer peak conditions in 2012.

Metering
The Interconnection Customer will be required to install and maintain metering and telemetry equipment to provide revenue metering and real-time telemetry data to PJM and the Transmission Owner. The PJM requirements for this equipment are listed in Appendix 2, section 8 of Attachment O to the PJM Tariff, as well as PJM Manuals 01 and 14D. The PJM and Transmission Owner requirements for Metering Equipment will be discussed in more detail in subsequent studies.

Design Requirements
The Interconnection Customer is responsible for specifying appropriate equipment and facilities such that the parallel generation is compatible with the FirstEnergy Transmission System. The Interconnection Customer is also responsible for meeting any applicable federal, state, and local codes. It is also the Interconnection Customer's responsibility to obtain any needed right-of-way between the plant site and FirstEnergy's facilities.

FirstEnergy will complete detailed relay coordination studies to identify off-site relay setting changes required due to this generation interconnection during the Facilities Study on construction phase of this project. This may result in additional individual relay replacements being required. These relay replacements will be done at the cost of the Interconnection Customer.

Reactive Power

Requirements to be provided during the System Impact Study or Facilities Study phase of the project studies.

Direct Connection
Connection to the Saxton 115 kV substation would be through a terminal position on a 5 breaker ring bus (see Figure 2).

The proposed interconnection facilities must be designed in accordance with the FirstEnergy "Requirements for Transmission Connected Facilities" document. Located at the following web address:

http://www.pjm.com/planning/design-engineering/to-tech-standards.aspx

Below are conceptual estimates for the engineering/construction associated with Direct Connection requirements based upon similar projects that have been designed and/or

constructed. The cost below is based on Queue Position #S-049 being the only project to connect at this substation.

Saxton 115 kV Substation

Item	Description	Conceptual Cost Estimate
1	Convert Saxton substation to five position ring bus rated at 1200A. This will include adding a 115kV breaker and replacing the existing tie breaker (800A), reconfiguring existing 115kV structure and adding a motorized get-away switch.	$1,747,800
2	115 kV transmission line extending from the new interconnection substation structure to the generation plant substation.	N/A Developer cost. Line built, owned and maintained by the developer.

Conceptual Estimate: $1,747,800
Estimated Lead Time: 15 months from signed CSA

Notes:
Detailed Engineering & Construction Estimates TBD via Facility Study.
The above estimates do not include 1) tax gross-up, 2) property costs and site development up to rough grade which is to be provided by the developer, 3) interconnection metering and generation SCADA to be provided by the developer, 4) engineering and field activities for design review and commissioning of the developer's facilities, 5) Real estate costs that may be required for right-of-way easements to extend the 115 kV line, and 6) Lead time assumes no permitting problems.

Network Impacts
Potential network impacts were as follows:

Generator Deliverability
(Single or N-1 contingencies for the Capacity portion only of the interconnection)

1. The Summit 115/46 kV #2 transformer is overloaded at 101% of the emergency rating (46.5 MVA) for the outage of Westfall – Q53 115 kV. The project contributes approximately 2.4 MW to cause the thermal violation. Install 70 MVA Transformer - $2,478,900 – 20 months engineering/construction time.

Multiple Facility Contingency
(Double Circuit Tower Line contingencies only for the full energy output. Stuck breaker and bus fault contingencies will be performed for the Impact Study)

2. The SAXTON-CURYVILE 115kV line loads from 88.05% to 180.83% of its emergency rating (179MVA) for the tower line outage of HOMER CT to

QUEMAHO 230 kV line and SEWARD to S11 115 kV line (2PN_WITH_S11A). This project contributes approximately 166.1 MW to cause this thermal violation. Curryville-Saxton 115kV - Reconductor 6.17 miles - $1,744,300. Curryville - Upgrade Claysburg Terminal - $131,800. It is estimated that engineering/construction will take 13 months.

3. The CURYVILE-CLYSBURG 115kV line loads from 77.29% to 170.36% of its emergency rating (179MVA) for the tower line outage of HOMER CT to QUEMAHO 230 kV line and SEWARD to S11 115 kV line (2PN_WITH_S11A). This project contributes approximately 166.6 MW to cause this thermal violation. Claysburg-Curryville 115kV Rebuild and reconductor 6.5 miles - $4,132,400. Claysburg - Upgrade Curryville Terminal - $417,400. It is estimated that engineering/construction will take 15 months.

Contribution to Previously Identified Overloads

(This project contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

4. Contribution of 26.90 MW further overloads to the 01GARRET 138/115kV transformer from 298.51% to 328.37% of its emergency rating (90 MVA) for the tower contingency HOMER CT TO QUEMAHO 115 kV line and SEWARD TO S11 115 kV line (Cont 2PN_WITH_S11A). Cost included in mitigation for #10.

5. Contribution of 105.5 MW further overloads the CLYSBURG-SUMMIT 115 kV line from 193.47% to 265.71% of its emergency rating (146 MVA) for the **tower** line outage HOMER CT to QUEMAHO 115 kV line and SEWARD to S11 115 kV line (2PN_WITH_S11A). Claysburg - Upgrade Summit Terminal - $250,100. Saxton - Upgrade Curryville Terminal - $97,900. Summit - Upgrade Claysburg Terminal - $331,600. Claysburg-Summit 115kV -Rebuild and reconductor 12.13 miles - $7,673,300. It is estimated that engineering/construction will take 19 months.

6. Contribution of 26.9 MW further overloads the Q34-ROCKWOOD 115 kV line loads from 112.21% to 129.14% of its emergency rating (159 MVA) for the tower line outage (2PN_WITH_S11A). Rockwood-Somerset Q34 115kV - Rebuild and reconductor 1.0 mile - $533,300. It is estimated that engineering/construction will take 11 months.

7. Contribution of 26.90 MW further overloads to the GARRETT – 01GARRET 115kV line from 218.16% to 239.66% of its emergency rating (125 MVA) for the **tower** contingency HOMER CT to QUEMAHO and SEWARD to S11 (cont 2PN_WITH_S11A). Garrett - Install Second Transformer to Double Size of TR #1 - $2,600,000. Garret-Garret Tap 115kV -Rebuild and reconductor 1.9 miles - $1,225,600. It is estimated that engineering/construction will take 20 months.

8. Contribution of 59 MW further overloads HILLCLAY – HILLTOP 115 kV from 233 % to 266% of its emergency rating (179 MVA) for the **tower** outage HOMER CT - QUEMAHONING and Seward – S11 230 kV line (Cont 2PN_WITH_S11A). Hilltop - Replace Hillclay terminal 115 kV breaker, switches and conductor (up to bus tie breaker) - $336,900. Hillclay-Hilltop 115kV - Rebuild and reconductor 4.73 miles - $2,965,600. It is estimated that engineering/construction will take 15 months.

9. Contribution of 27 MW further overloads ROCKWOOD – PENN-MAR 115 kV from 179% to 198% of its emergency rating (143 MVA) for the **tower** outage HOMER CT - QUEMAHO and Seward – S11 230 kV line (Cont 2PN_WITH_S11A). Penn Mar-Rockwood 115kV - Rebuild and reconductor 14.7 miles - $8,692,800. Rockwood - Upgrade Penn Mar Terminal - $192,800. PennMar - Upgrade Rockwood Terminal - $284,000. It is estimated that engineering/construction will take 15 months.

10. Contribution of 27 MW further overloads PENN-MAR to GARRET 115 kV line from 153% to 169% of its emergency rating (167 MVA) for the **tower** outage HOMER CT - QUEMAHO and Seward – S11 230 kV line (Cont 2PN_WITH_S11A). PennMar - Replace conductors and wave trap associated with the Garrett 115 V Line - $122,500. Garret-Penn Mar 115kV - Rebuild and reconductor 14.95 miles - $8,838,700. It is estimated that engineering/construction will take 22 months.

11. Contribution of 46.7 MW further overloads to the HILLTOP – ROSEDALE 115 kV line from 142.19% to 168.27% of its emergency rating (179 MVA) for the **tower** contingency HOMER CT to QUEMAHO and SEWARD to S11 (Cont 2PN_WITH_S11A). Hilltop - Replace conductors and wave trap associated with the Rosedale 115 V Line - $113,000. It is estimated that engineering/construction will take 8 months.

12. Contribution of 40.2 MW further overloads to the ROSEDALE – COOPER 115kV line from 107.91% to 130.23% of its emergency rating (180 MVA) for the **tower** contingency HOMER CT to QUEMAHO and SEWARD to S11 (cont 2PN_WITH_S11A). Included in 18 below.

13. Contribution of 42.0 MW further overloads to the COOPER – SEWARD 115kV line from 106.17% to 129.00% of its emergency rating (184 MVA) for the **tower** contingency HOMER CT to QUEMAHO and SEWARD to S11 (cont 2PN_WITH_S11A). Cooper - Upgrade Rosedale Junction & Seward Terminals - $276,400. It is estimated that engineering/construction will take 9 months.

14. Contribution of 26.0 MW further overloads to the LEWISTWN - JUNIATA 230 kV line from 101.3% to 105.51% of its emergency rating (617 MVA) for the **tower** outage of Brighton – Kempton 500 kV line ckt#1 and Brighton – Kempton

500 kV line ckt#2 (Cont 19). Juniata-Lewistown 230kV - Reconductor 24.7 miles - $13,834,200. It is estimated that engineering/construction will take 31 months.

Short Circuit

PJM studied the 230kV and above system and found no new breakers overdutied, and no significant contribution to previously identified overdutied breakers. Additional short circuit study will occur during the Impact Study of this project.

Delivery of Energy Portion of Interconnection Request

PJM also studied the delivery of the energy portion of this interconnection request. Any problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request. The developer can proceed with Network Upgrades to eliminate the operational restriction at their discretion by submitting a Transmission Interconnection Request. Note: Only the most severely overloaded conditions are listed below. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed which shall study all overload conditions associated with the overloaded element(s) identified.

As a result of the aggregate energy resources in the area, the following violations were identified:

1. Contribution of 27.7 MW further overloads to the Q53TAP – WESTFALL 115 kV line from 119.65% to 135.12% of its emergency rating (179 MVA) for the outage of N39C – JOHNSTOWN 230 kV line (Cont. PN48B).

2. Contribution of 27.7 MW further overloads to the SUMMIT – Q53TAP 115 kV line from 119.65% to 135.12% of its emergency rating (179 MVA) for the outage of N39C – JOHNSTOWN 230 kV line (Cont. PN48B).

3. Contribution of 6.8 MW further overloads to the SHADE GP - ROXBURY 115kV line from 115.87% to 120.42% of its emergency rating (150 MVA) for the outage of S44 – JUNIATA line (Cont PN29_WITH_S44OPT1B).

4. Contribution of 141.1 MW further overloads to the CLYSBURG – SUMMIT 115 kV line from 121.5% to 200.6% of its emergency rating (179 MVA) for the outage of Salix – O18 115 kV line.

5. Contribution of 39.4 MW further overloads to the O17 – SOMERST 115kV line from 101.55% to 135.82% of its normal rating (115 MVA).

6. Contribution of 27.2 MW further overloads to the Q53 TAP - WESTFALL 115 kV line from 97.7% to 112.8% of its normal rating (174 MVA).

7. Contribution of 41.3 MW overloads the O17 – SOMERST 115kV line from 85.2% to 113% of its emergency rating (150 MVA) for the outage of WESTFALL_- Q53 115 kV line.

8. Contribution of 27.2 MW overloads to the SUMMIT – Q53TAP 115 kV line from 87.91% to 103.5% of its normal rating (174 MVA).

9. Contribution of 21.1 MW further overloads the Blairsville 138/115 kV transformer from 180% to 195% of its emergency rating (140 MVA) for the outage of HANDSMLK - WAYNE 345 kV line (Cont PN33A).

10. Contribution of 30.0 MW further overloads to the HOOVERSV - TOWER 51 115 kV line from 260.5% to 281.12% of its emergency rating (146 MVA) for the outage of QUEMAHON - HOMER CT and QUEMAHON – R56OPT1 230 kV line (Cont PN37_WITH_R56OP1_A).

11. Contribution of 30.3 MW further overloads to the S11C – SEWARD 115kV line from 258.81% to 277.85% of its emergency rating (159 MVA) for the outage of QUEMAHON - HOMER CT and QUEMAHON – R56OPT1 230 kV line (Cont PN37_WITH_R56OP1_A).

12. Contribution of 12.6 MW further overloads to the HOOVERSV - TOWER 51 115 kV line from 157% to 167% of its normal rating (125 MVA).

13. Contribution of 10.6 MW further overloads to the 01SOCIAL – 01VASC 138kV line from 119% to 127% of its emergency rating (129 MVA) for the outage of MurryC – Springdale 138 kV line.

14. Contribution of 2.4 MW overloads the Q36 – PHILIPSB 115 kV line is overloaded from 89.45% to 104.81% of its emergency rating (146 MVA) for the outage of RAYSTOWN - ALTOONA 230 kV line and RAYSTOWN - LEWISTWN 230 kV line (Cont PN38).

15. Contribution of 16.9 MW further overloads to the Blairsville 138/115 kV transformer from 155% to 168% of its normal rating (129 MVA).

16. Contribution of 28.5 MW further overloads to the SEWARD - FLORENCE 115kV line from 180% to 195.45% of its emergency rating (184 MVA) for the Outage of SHELOCTA - HOMER CT 230 kV line and SHELOCTA - KEYSTONE 230 kV line (Cont PN41).

17. Contribution of 13 MW further overloads to the TOWER 51 – S11C 115kV line from 136% to 146% of its normal rating (130 MVA).

18. Contribution of 11.6 MW further overloads the S14C – 01RIDGLY 138 kV line from 114.15% to 120.17% of its emergency rating (193 MVA) for the outage of ALBRIGT - N33 C 138 kV line (Cont APS-SB-79A).

19. Contribution of 21.1 MW further overloads to the BLAIRSVL – 01SOCIAL 138kV line from 142.92% to 154.92% of its emergency rating (176 MVA) for the outage of HANDSMLK - WAYNE 345 kV line (Cont PN33A).

20. Contribution of 14.5 MW further overloads to the N33 C – 01ALBRIGT 138 kV line from 119.50% to 126.69% of its emergency rating (201 MVA) for outage of S14 - RIDGLY 138 kV line (Cont APS-SB-509_WITH_S14B).

21. Contribution of 27 MW further overloads to the S44COP1 – JUNIATA 230kV line from 115% to 120% of its emergency rating (617 MVA) for Outage of Juniata – Keystone 500 kV line (PJM24B).

22. Contribution of 17 MW further overloads to the BLAIRSVL – 01SOCIAL 138kV line from 133% to 145% of its normal rating (150 MVA).

23. Contribution of 26.2 MW further overloads to the S44COP1 – JUNIATA 230kV line from 119.65% to 124.90% of its normal rating (499 MVA).

24. Contribution of 34.7 MW further overloads to the ALTOONA – RAYSTOWN 230 kV line from 109.99% to 116.26% of its emergency rating (554 MVA) for the outage of SHELOCTA to HOMER CT 230 kV line and SHELOCTA KEYSTONE 230 kV line (Cont PN41).

25. Contribution of 22.6 MW further overloads to the ROCKWOOD – PENN-MAR 115 kV line from 132.77% to 148.54% of its emergency rating (143 MVA) for the outage of SHELOCTA - HOMER CT 230 kV line and SHELOCTA - KEYSTONE 230 kV line (Cont PN41).

26. Contribution of 15 MW further overloads to the ROCKWOOD – PENN-MAR 115 kV line from 109% to 121.58% of its normal rating (124 MVA).

27. Contribution of 36.9 MW further overloads to the RAYSTOWN – LEWISTWN 230 kV line from 106.7% to 113.36% of its emergency rating (554 MVA) for the Outage of SHELOCTA to HOMER CT 230 kV line and SHELOCTA to KEYSTONE 230 kV line (Cont PN41).

28. Contribution of 25.9 MW further overloads to the RAYSTOWN – LEWISTWN 230 kV line from 95% to 100.26% of its normal rating (478 MVA).

29. Contribution of 15.3 MW further overloads to the PENN-MAR - GARRETT 115 kV line from 105% to 116.85% of its normal rating (129 MVA).

30. Contribution of 69.7 MW further overloads to the HOMER CT – SHELOCTA 230kV line from 138.1% to 146.2% of its emergency rating (841 MVA) for the outage of HANDSMLK - WAYNE 345 kV line (Cont PN33A).

31. Contribution of 22.5 MW further overloads to the PENN-MAR - GARRETT 115 kV line from 113.67% to 127.17% of its emergency rating (167 MVA) for the Outage of SHELOCTA - HOMER CT 230 kV line and SHELOCTA - KEYSTONE 230 kV line (Cont PN41).

32. Contribution of 01VASC T – 01EDGEWT 138kV line is overloaded from 91.41% to 101.5% of its normal rating (106 MVA).

33. Contribution of 22.2 MW further overloads to the SEWARD - FLORENCE 115kV line from 118.4% to 132.5% of its normal rating (162 MVA).

34. Contribution of 16.8 MW further overloads to the 01EDGEWT – 01LOYALH 138 kV line from 111.73% to 124.73% of its emergency rating (129 MVA) for the outage of SHELOCTA - HOMER CT 230 kV line and SHELOCTA - KEYSTONE 230 kV line (Cont PN41).

35. Contribution of 28.5 MW further overloads to the FLORENCE – BLRSVL E 115 kV line from 125.2% to 136.4% of its emergency rating (263 MVA) for the outage of SHELOCTA - HOMER CT 230 kV line and SHELOCTA - KEYSTONE 230 kV line (Cont PN41).

36. Contribution of 14.5 MW overloads the 01GARRET – N33 C 138 kV line from 93.85% to 101.05% of its emergency rating (201 MVA) for the outage of S14 - 4 01RIDGLY 138 kV line (Cont APS-SB-509_WITH_S14B).

37. Contribution of 26.2 MW further overloads to the LEWISTWN – S44COP1 230 kV line from 104.94% to 110.19% of its normal rating (499 MVA).

38. Contribution of 76.5 MW further overloads to the SHELOCTA – KEYSTONE 230 kV line from 124.28% to 133.24% of its emergency rating (854 MVA) for the outage of HANDSMLK - WAYNE 345 kV line (Cont PN33A)

39. Contribution of 62 MW further overloads to the HOMER CT – SHELOCTA 230 kV line from 119.8% to 128.6% of its normal rating (718 MVA).

40. Contribution of 69.2 MW further overloads to the SHELOCTA – KEYSTONE 230 kV line from 93.2% to 101.7% of its emergency rating (841 MVA).

41. Contribution of 54.3 MW overloads the KEYSTONE transformer 500/230 kV ckt#4 from 91.46% to 100.02% of its emergency rating (634 MVA) for the outage of KEYSTONE 500/230 ckt#3 (Cont PJM30).

42. Contribution of 30.3 MW further overloads to the TOWER 51 – S11C 115kV line from 222.29% to 241.33% of its emergency rating (159 MVA) for the outage of QUEMAHON - HOMER CT and QUEMAHON – R56 230 kV line (Cont PN37_WITH_R56OP1_A).

43. Contribution of 10.7 MW further overloads to the 01SOCIAL – 01VASC 138kV line from 118.11% to 128.183% of its normal rating (106 MVA).

44. Contribution of 11 MW overloads the 01VASC T – 01EDGEWT 138 kV line from 99.41% to 107.91% of its emergency rating (129 MVA) for outage of HOMER CY - WATRC345 345 kV line (Cont PN18).

45. Contribution of 13.1 MW further overloads to the S11C – SEWARD 115kV line from 177% to 187% of its normal rating (130 MVA).

46. Contribution of 26 MW further overloads the LEWISTWN-JUNIATA 230 kV line from 114.2% to 119.4% of its normal rating (499 MVA) for non-contingency condition.

Figure 1

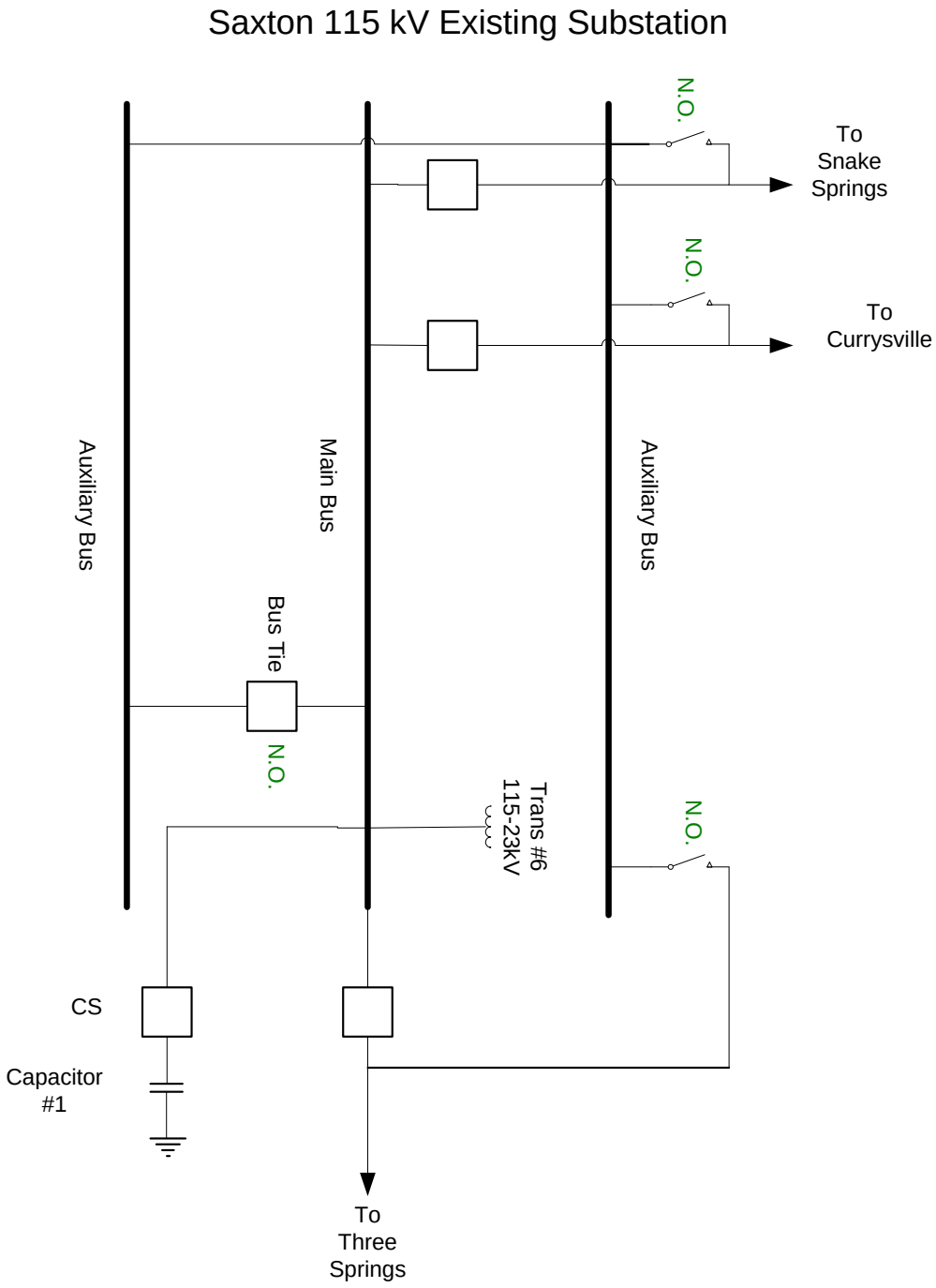
Saxton 115 kV Existing Substation
N.O.
To
Snake
Springs
N.O.
To
Currysville
Auxiliary Bus
Main Bus
Auxiliary Bus
Bus Tie
N.O.
Trans #6
115-23kV
N.O.
CS
Capacitor
#1
To
Three
Springs

Figure 2

Saxton 115 kV Rebuilt Substation